Service Manual

StringPin Pinsetter

Ten Pin

April 2013 / 55-900001-000

Brunswick®

CUSTOMER SERVICE

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StringPin Pinsetter Service Manual

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Manual Part No. 55-900001-000

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Brunswick Bowling & Billiards Corporation
525 West Laketon Avenue
P.O. Box 329
Muskegon, MI 49443-0329
U.S.A.

231.725.3300

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Section 1 - SAFETY!

NOTES & WARNINGS

Throughout this publication, “Warnings”, and “Cautions” (accompanied by one of the International HAZARD Symbols) are used to alert the mechanic to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. They are defined below. OBSERVE AND READ THEM CAREFULLY!

These “Safety Alerts” alone cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus training and “Common Sense” operation are major accident prevention measures.

NOTE or IMPORTANT!: Will designate significant informational notes.

WARNING! Will designate a mechanical or nonelectrical alert which could potentially cause personal injury or death.

WARNING! Will designate electrical alerts which could potentially cause personal injury or death.

CAUTION! Will designate an alert which could potentially cause product damage.

Will designate grounding alerts.

SAFETY NOTICE TO USERS OF THIS MANUAL

This manual has been written and published by the Service Department of Brunswick Bowling and Billiards to aid the reader when servicing or installing the products described.

It is assumed that these personnel are familiar with, and have been trained in, the servicing or installation procedures of these products, which includes the use of common mechanic’s hand tools and any special Brunswick or recommended tools from other suppliers.

We could not possibly know of and advise the reader of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of each method. We have not attempted any such wide evaluation. Therefore, anyone who uses a service procedure and/or tool, which is not recommended by Brunswick, must first completely satisfy himself that neither his nor the product’s safety will be endangered by the service procedure selected.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication.

It should be kept in mind, while working on the product, that the electrical system is capable of violent and damaging short circuits or severe electrical shocks. When performing any work where electrical terminals could possibly be grounded or touched by the mechanic, the power to the product should be disconnected prior to servicing and remain disconnected until servicing is complete.

SAFETY REQUIREMENTS FOR STRING PIN PINSETTERS

As with all machinery, a certain amount of risk is involved in working on the String Pin Pinsetter. However, if the necessary care, knowledge and responsibility are exercised, damage to the pinsetter and people involved in accidents can be avoided. The following steps should be taken:

Safety Guidelines

1. **ONLY PROPERLY TRAINED PEOPLE ARE QUALIFIED TO WORK ON OR OPERATE THE PINSETTER.**

2. Never bypass, disable, or tamper with the safety interlocks or pinsetter function switches.

3. Always face toward the machine when using the ladder to climb onto or off the machine. Only one person should be on the ladder at any time.

4. Suitable clothing must be worn (for example: rubber-soled shoes). Do not wear loose clothing such as neckties or smocks that could get caught in moving parts. Remove rings, watches, earrings, bracelets and other jewelry to avoid injury.

5. Care should be taken while near the front of the machine. Accidentally blocking the photocell beam with will cause the pinsetter to cycle.

6. Always turn the Pinsetter off before working on the machine.

7. If more than one person is working on a machine or if a stop/run switch will be out of reach while working on the machine, lockout the controller power switch to prevent a person from turning on the pinsetter before the other person says he/she is clear of the pinsetter.

8. Fire extinguishers must be on hand and maintained properly. Keep oily rags and other combustibles in approved fire proof containers.

9. If more than one person is working on a machine, be sure the other person is CLEAR before restarting the machine.

10. When working in the pinsetter area while machines are in operation, ear protection should be worn.

11. Never work on or around the pinsetter while under the influence of alcohol, drugs, or any other substance that can impair your physical abilities or mental judgment.

12. Always use the correct tools for the job.

13. Poisonous or toxic cleaners must not be used. Always check the material safety data sheets before using new cleaners.

14. Always use factory approved parts when repairing the pinsetter. Using substandard parts may pose a safety risk.

Section 2 - Overview

MACHINE COMPONENT LOCATION AND DESCRIPTION

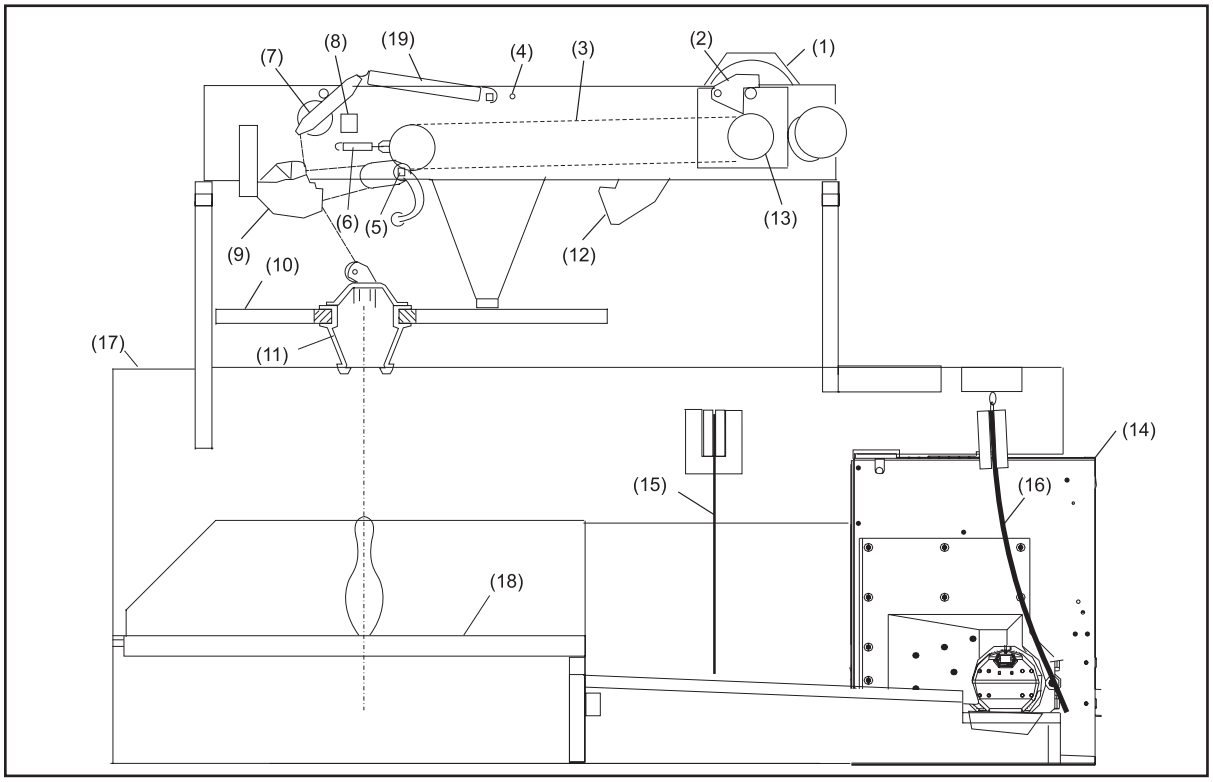


Figure 2-1. Machine Component Location and Description

1 MOTOR AND GEAR ASSEMBLY
2 STOP DOGS FOR STRING WAGONS (PIN UP POSITION)
3 CHAIN TRACK
4 STRING LIMITING BAR
5 STRING WAGON
6 CHAIN TENSION SPRING
7 STRING SPOOL RESERVE
8 DETANGLING BAR AND SWITCH
9 STRING PINSETTER INTERFACE CONTROL (SPIC)
10 PIN TABLE
11 PIN CENTERING CONES
12 SLOW SETTING PIN CAM
13 CAM AND REED SWITCH CLUSTER
14 BALL BOX WITH ACCELERATOR
15 PIT CURTAIN
16 BALL STOP
17 RETURN KICKBACK
18 PIN DECK
19 STRING SPOOL SPRING

PINSETTER IS READY FOR BOWLING

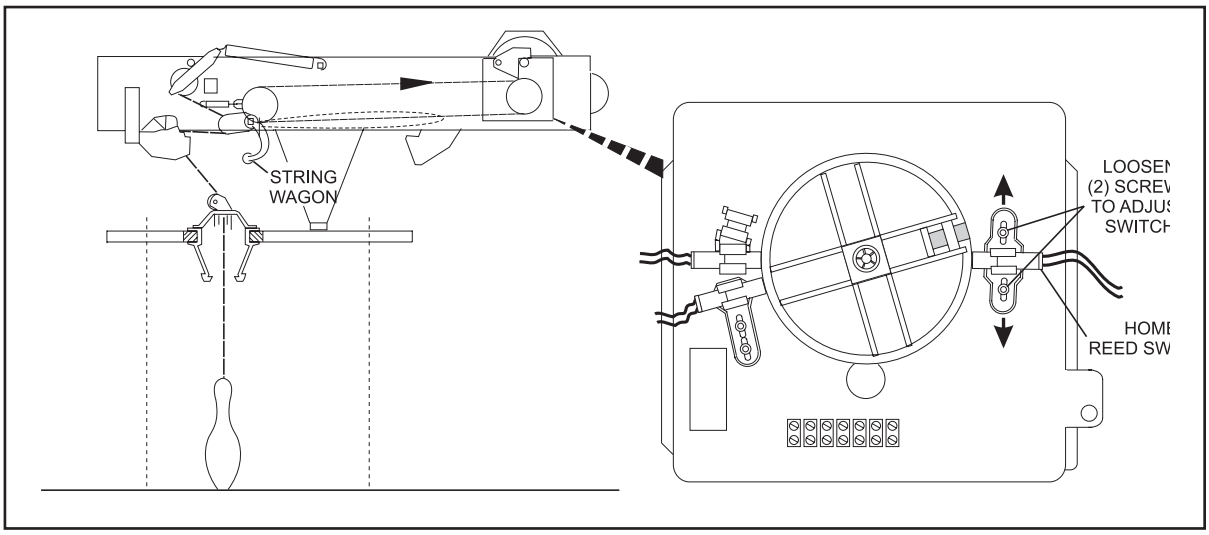


Figure 2-2. Pinsetter is Ready for Bowling

1 STRING WAGON
2 PINSETTER
3 MAGNET
4 HOME SWITCH (PINS ON PINDECK)

1. With ten pins setting on the pin deck, the string wagon will be positioned at the front of the machine. Refer to *Figure 2-2.*

2. The magnet in the cam control box will be positioned just above the home switch. Refer to *Figure 2-2.*

Section 3 - Operation and Cycle

ACTIONS THAT START A MACHINE CYCLE

Any of the following occurrences will cycle the pinsetter.

1. Pushing the reset buttons on the ball rack.
2. A bowling ball knocking over one or more pins.
3. The second ball in a frame breaking the photo cell beam.
4. Switch ON main power located on the controller.
5. Sending a “Reset” signal over the RS232.

DESCRIPTION OF CYCLES DURING BOWLING (WITH THE TIME DELAY SWITCH SET AT S3)

Strike

Three seconds after the first pin falls, all ten pins are raised to the full up position and reset.

First Ball Thrown is a Gutter Ball

The machine will receive and remember the ball detect signal. There is no machine activity and after five seconds the machine is ready for the second ball.

First Ball Thrown Part of Pins Knocked Down

Three seconds after the first pin is knocked over all ten pins will be raised. Those that were left standing will be respotted.

After Second Ball of Frame is Thrown

Three seconds after receiving a ball detect signal the machine will raise remaining pins and set ten new pins.

PINSETTER SWITCH FUNCTIONS

Detangle Switch

If the string of two or more pins become tangled as they are being raised, the tension lever assembly will rotate and actuate the detangle switch. Refer to *Figure 3-1.*

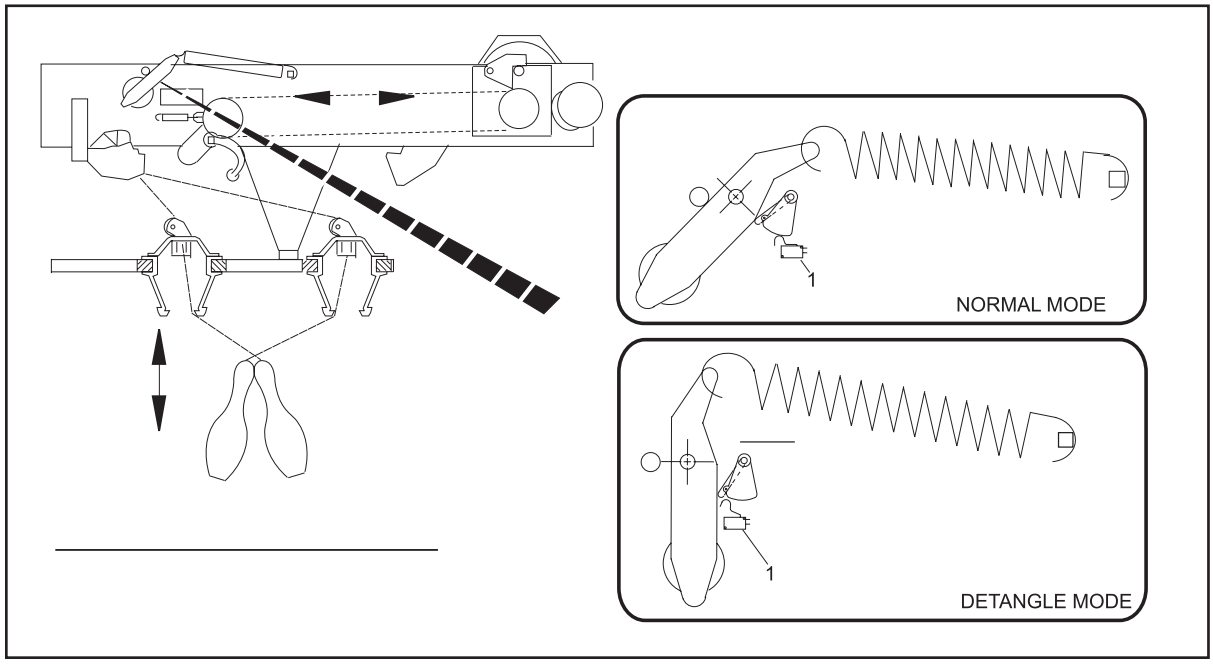


Figure 3-1. Disentangle Switch Activation

1 DETANGLE SWITCH

When the detangle switch is actuated and the pins are not fully up, the machine will stop raising the pins and start shaking them up and down. This shaking action will continue until the pins are no longer tangled or a service person turns off the machine and manually corrects the problem. Refer to *Figure 3-2.*

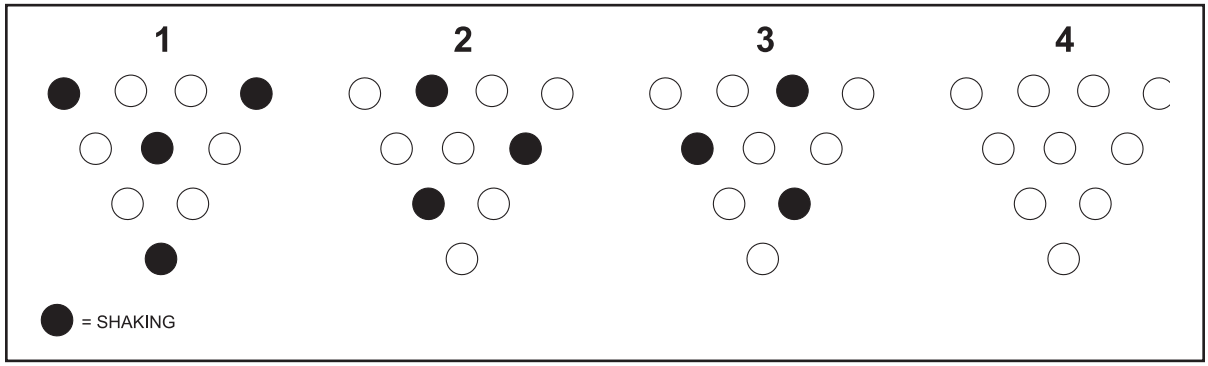


Figure 3-2. Shaking Action of Detangle Switch

1 1ST SHAKE
2 2ND SHAKE
3 3RD SHAKE
4 FINAL SHAKE - ALL FREE

Pins Up Push Button (Pins Up Button on Side of Controller)

The machine will lift the pins to the full up position. At this time, the magnet in the cam control box will actuate the pins up control switch and stop the motor. Refer to *Figure 3-3*.

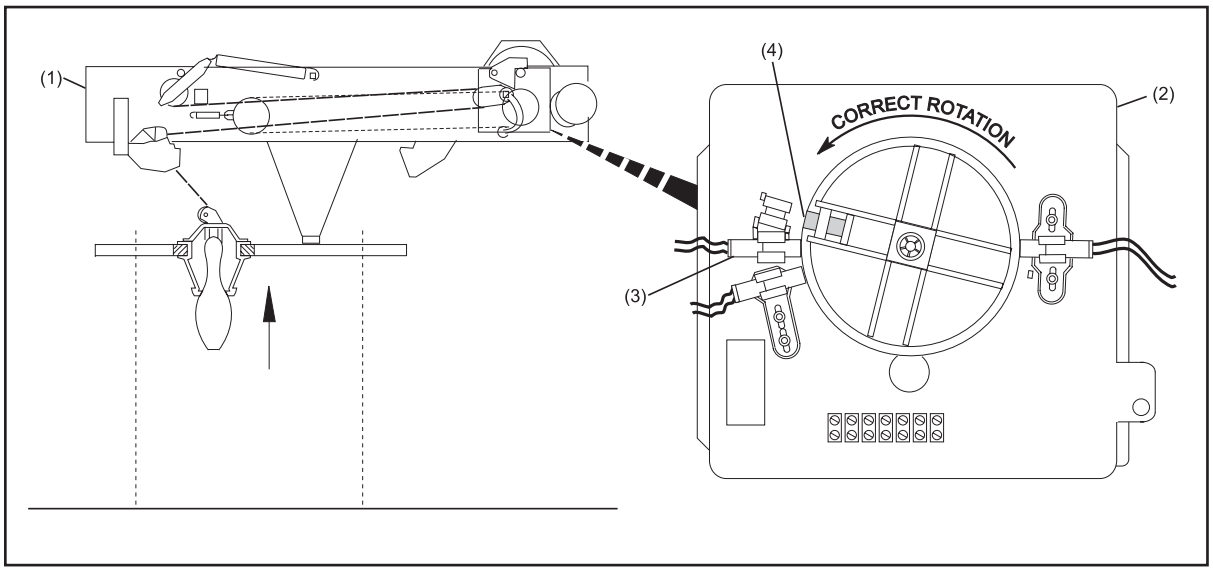


Figure 3-3. Pins Up Position

1 PINSETTER
2 CAM CONTROL BOX
3 PINS UP REED SWITCH (ONLY ADJUSTABLE WITH CAM GEAR)
4 MAGNET

Fallen Pin Brake Switch

The fallen pin brake switch holds the pins knocked over from the first ball of a standing pin cycle, in the up position. After the string wagon has passed the pins up position, the magnet in the cam box activates the fallen pin brake switch which tells the SPIC (StringPin Pinsetter Interface Control) to keep the knocked over pins in the up position. Refer to *Figure 3-4.*

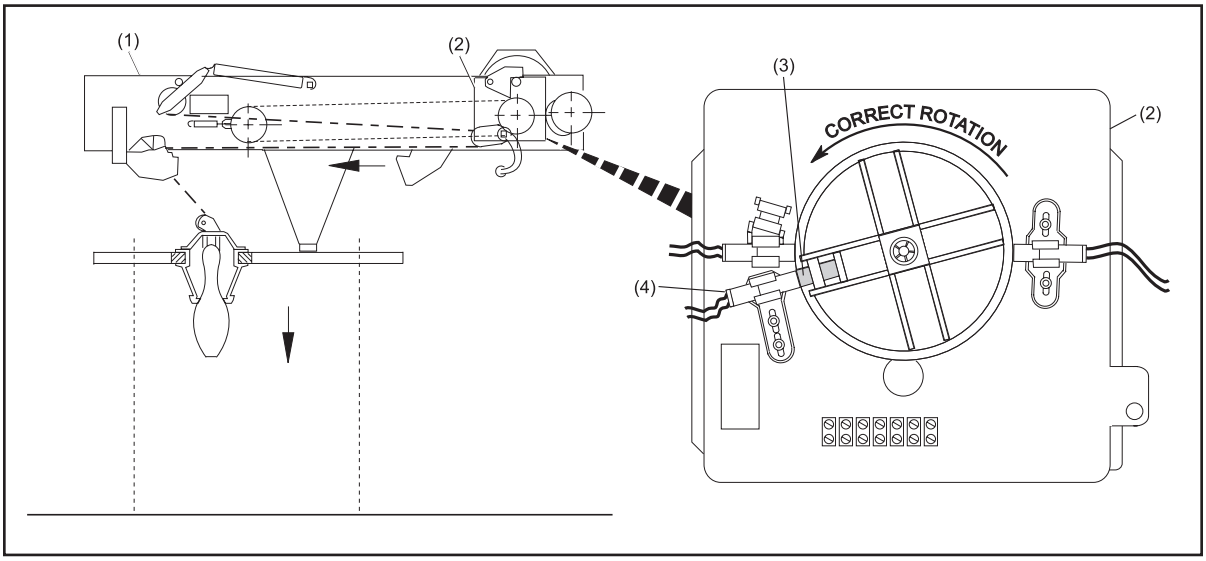


Figure 3-4. String Brake Switch

1 PINSETTER
2 CAM CONTROL BOX
3 MAGNET
4 FALLEN PIN BRAKE SWITCH (FOR THE SECOND BALL FRAME)

Slow Setting Pin Cam

The slow setting pin cam`s function is to slow down the speed at which the pins are moving as they are being set on first ball or respotted on second ball. There is one of these cams on each side of the frame at the pit end of the pinsetter. This cam changes the path of the string during the down motion which slows the travel of the pins. Reference *Figure 3-5.*

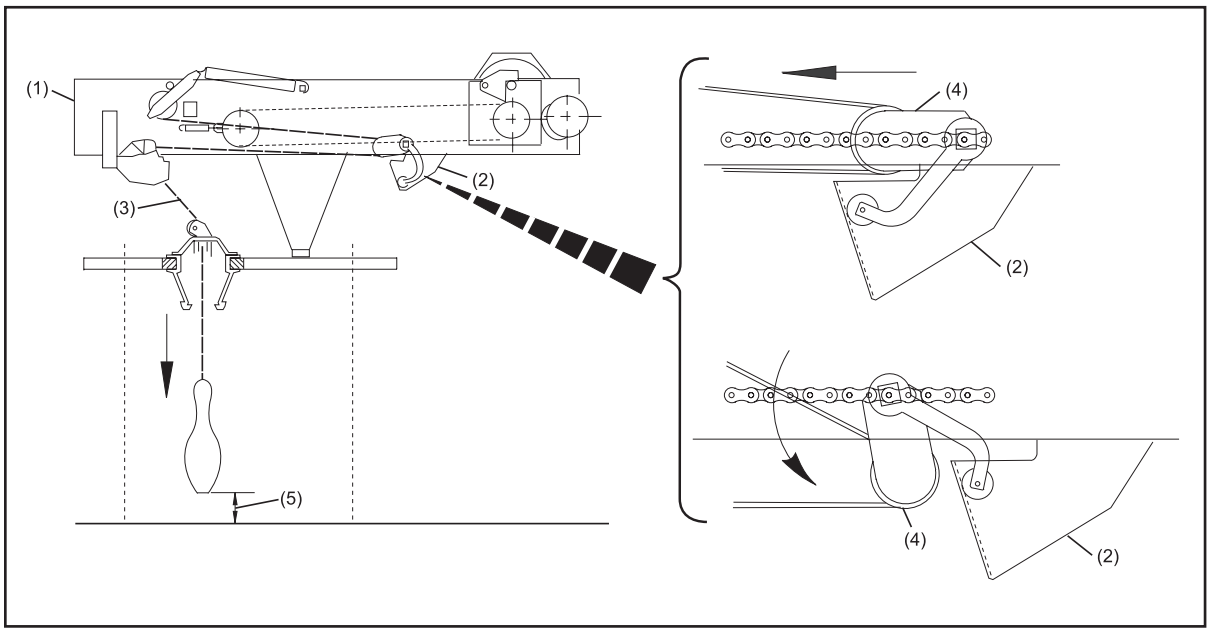


Figure 3-5. Pin Setting Cam

1 PINSETTER
2 SLOW SETTING PIN CAM
3 STRING
4 STRING WAGON
5 PIN IS NOT ON PIN DECK

StringPin Pinsetter Interface Control (Spic)

The string control assembly consists of ten each of the following components: Refer to *Figure 3-6.*

- Solenoid to operate the string brake
- String Brake
- String
- Reed Switch
- Magnet
- Friction Clutch
- String Roller

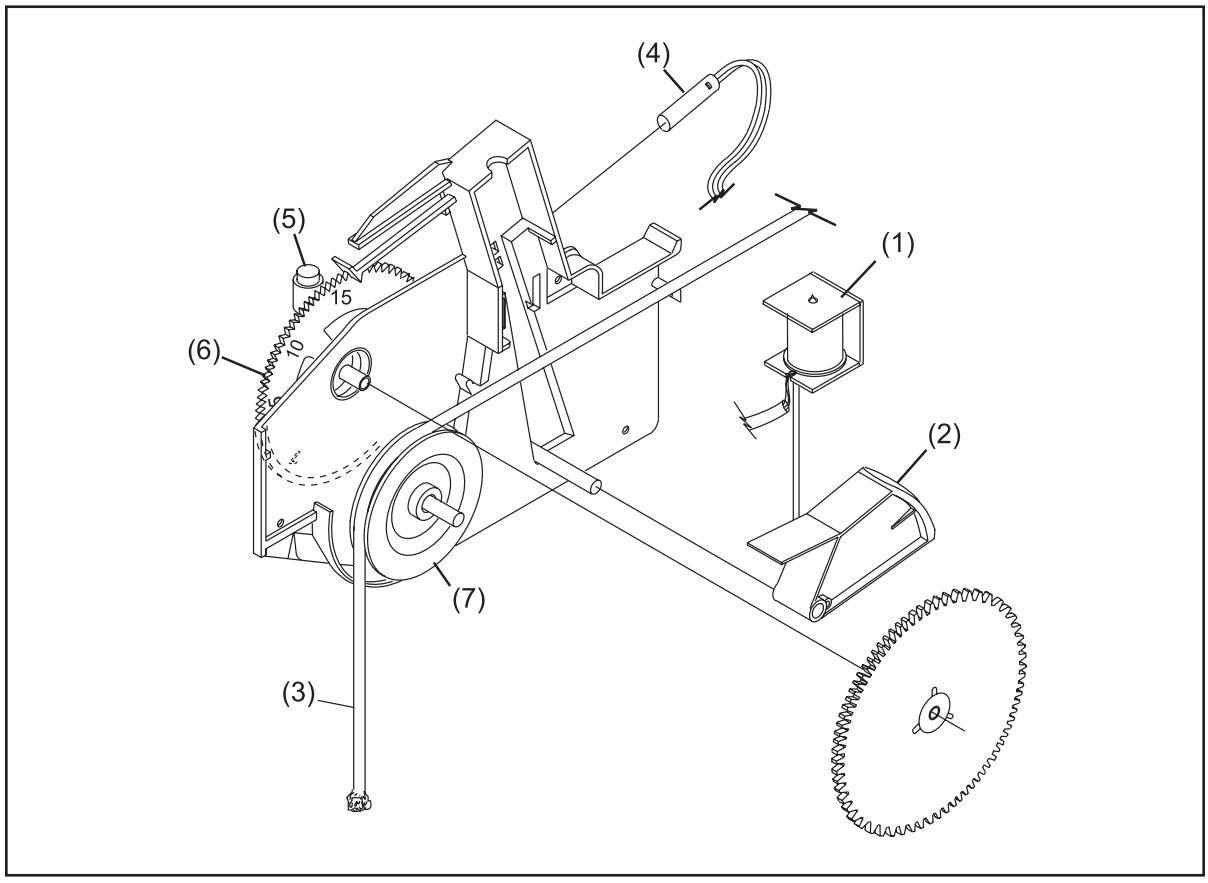


Figure 3-6. String Control Components

1 SOLENOID
2 STRING BRAKE
3 STRING
4 REED SWITCH
5 MAGNET
6 FRICTION CLUTCH
7 STRING ROLLER

STAND ALONE MODE (NO SCORING)

The start up procedure is intended to be completed without scoring. All the adjustments and calibrations with the string pinsetter can be completed in stand alone mode with NO scoring needed.

Configuration

1. Check motor for 50 Hz or 60 Hz configuration.

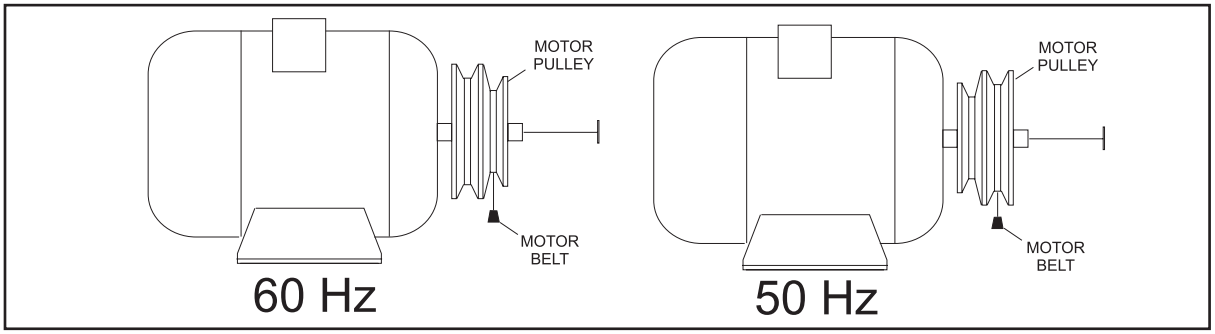


Figure 4-1. Motor Configuration

2. Remove the 4 position connector at "EIN" on the CPU board. Refer to *Figure 4-2*.

3. Check all fuses to make sure they are correct for the voltage of the machine.

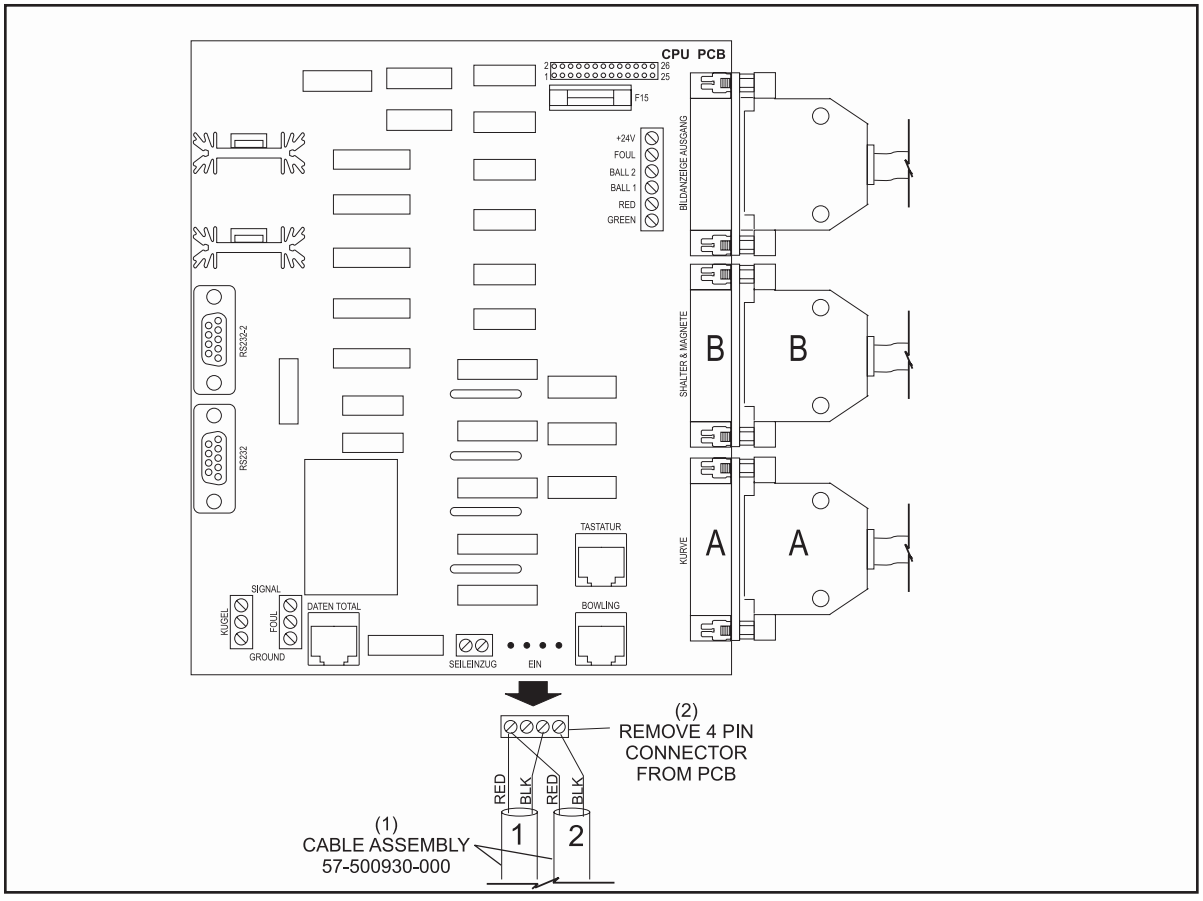


Figure 42. Remove 4 Position Connector from CPU PCB

1 CABLE ASSEMBLY 57-00930-000

2 REMOVE 4 PIN CONNECTOR FROM PCB

Pins Up Button

1. Turn on Main power to the string pinsetter.

2. With the connector removed from step 1 of the “Configuration” section, press the “Pins Up” button on the side of the control box. Refer to *Figure 4-3.*

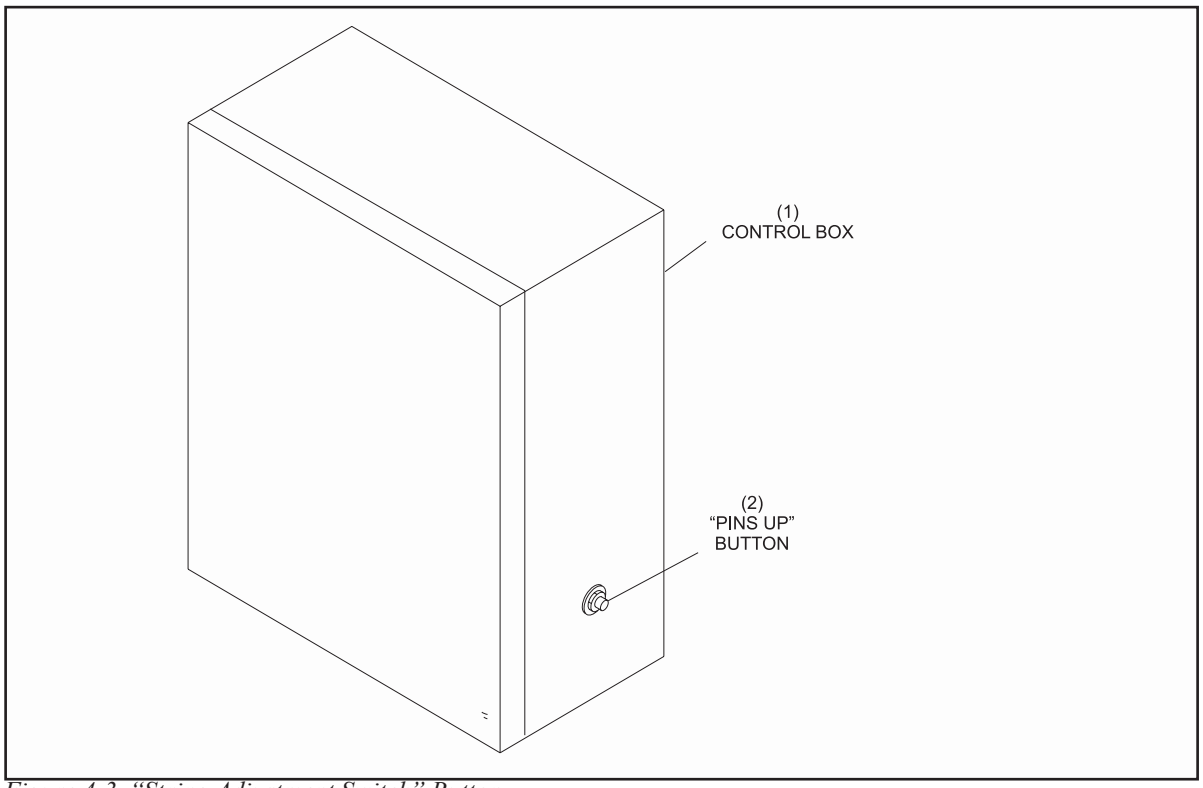


Figure 4-3. “String Adjustment Switch” Button

1 CONTROL BOX 2 “PINS UP” BUTTON

3. The machine will bring the pins up or lower the pins to the deck every time the button is pressed.

Motor Rotation

1. Make sure wagon is off the stop dogs. Cycle power to make sure motor/wagon is turning in the correct direction.

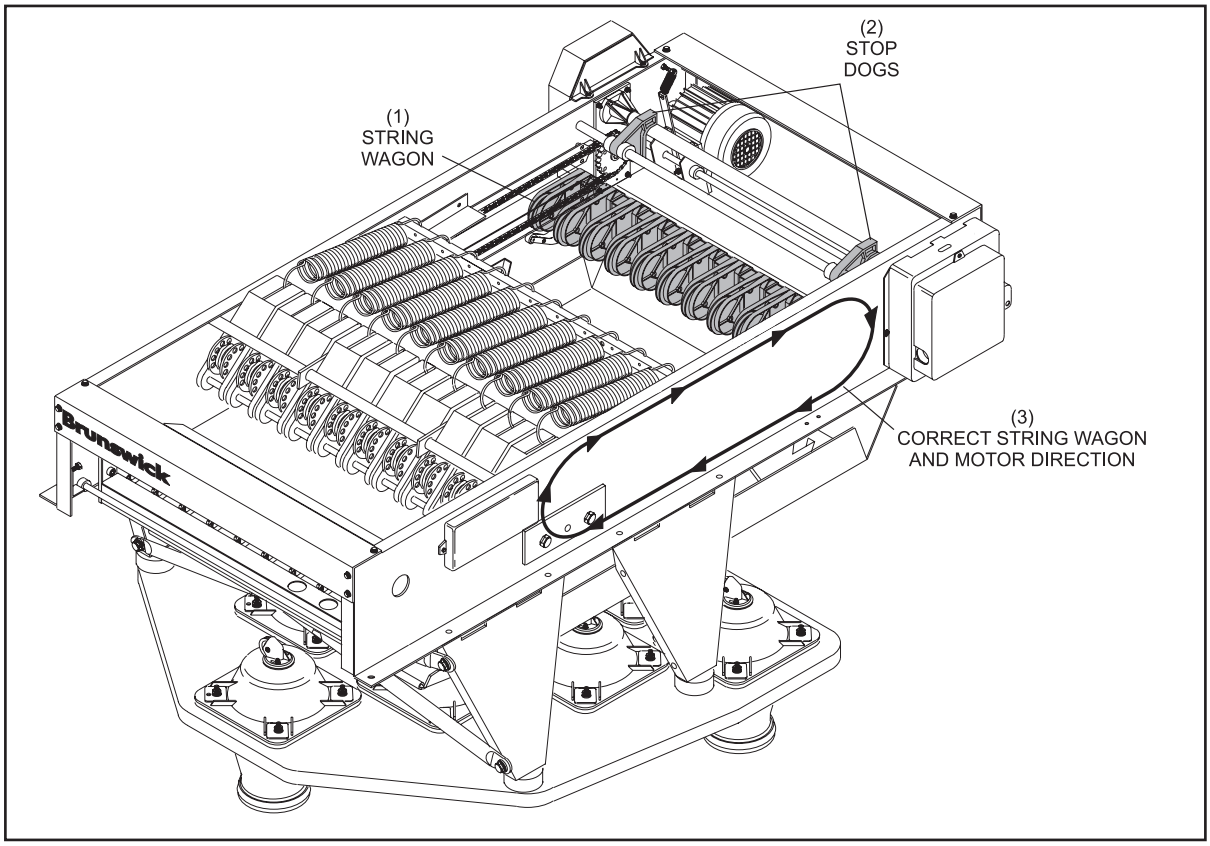


Figure 4-4. Correct Wagon Rotation Direction

1 STRING WAGON
2 STOP DOGS
3 CORRECT STRING WAGON AND MOTOR DIRECTION

Warning!: Make sure the wagon is off the stop dogs when testing the motor direction. Until the motor direction is correct do not have the wagon come in contact with the stop dogs or mechanical failure could occur.

Cam Adjustment

1. Cycle the machine to verify if the cam is adjusted properly. The wagon should stop on the dogs correctly. Refer to below for cam adjustment.

   If the wagon does not travel to the stop dogs:

   - The motor will turn off, the pins will fall to the pin deck until the motors starts again. This cycle will continue until the cam is adjusted.

   If the wagon does travel to the stop dogs but over travels:

   - The motor will turn off late, and the wagon will slam onto the stop dogs.

   If none of these issues occur skip to step 8.

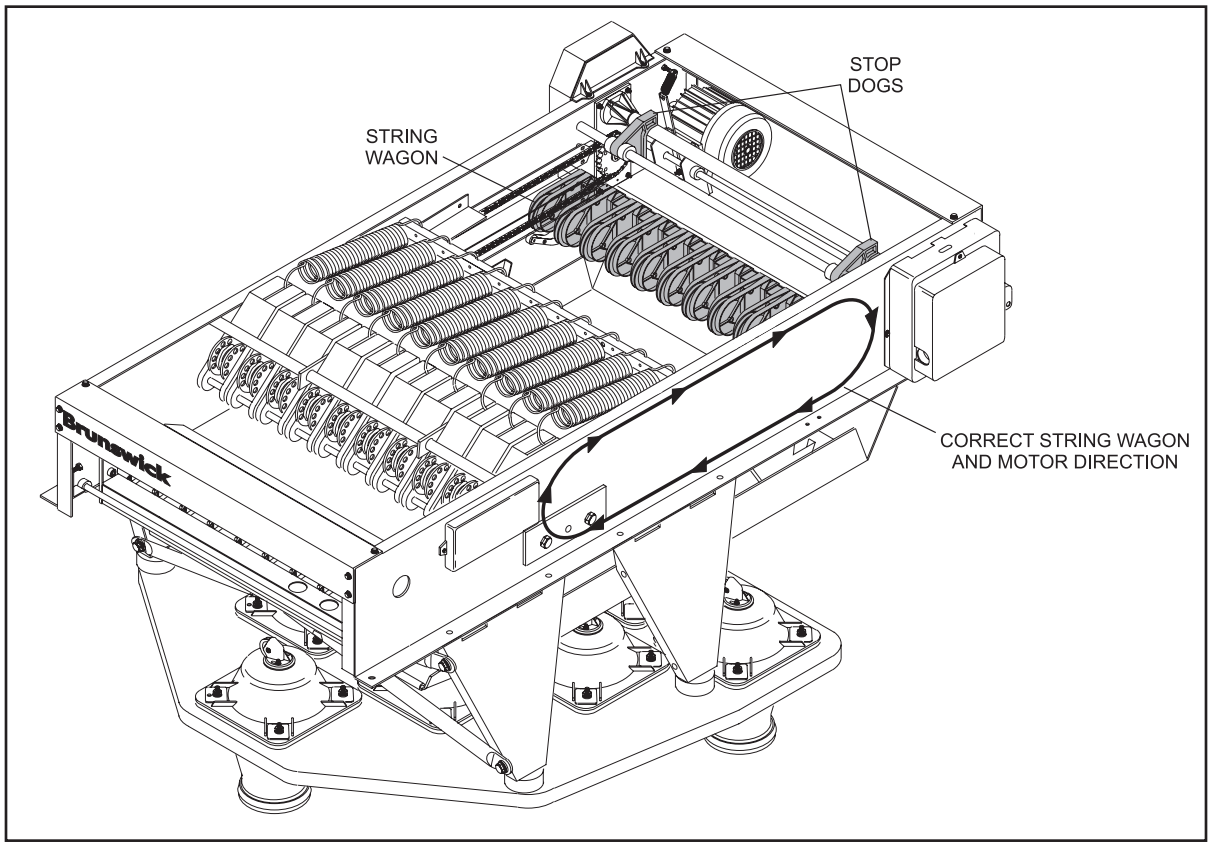


Figure 4-5. Cycle Machine

1 STRING WAGON
2 STOP DOGS
3 CORRECT STRING WAGON AND MOTOR DIRECTION

a. The cam will need be adjusted differently depending on the operation of the machine. Refer to *Figure 4-6*.

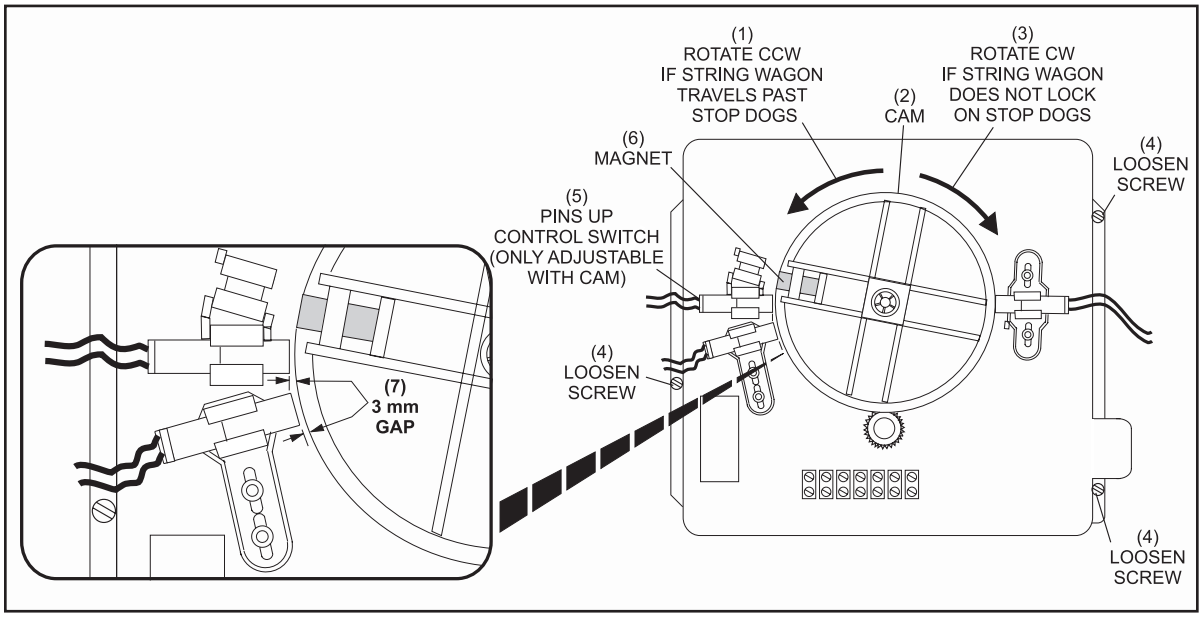


Figure 4-6. Cam Adjustment

1. ROTATE CCW IF STRING WAGON TRAVELS PAST STOP DOGS
2. CAM
3. ROTATE CW IF STRING WAGON DOES NOT LOCK ON STOP DOGS
4. LOOSEN SCREW
5. PINS UP CONTROL SWITCH (ONLY ADJUSTABLE WITH CAM)
6. MAGNET

b. Loosen the (3) screws for the Cam Control Box. Refer to *Figure 4-6*.

NOTE: *DO NOT REMOVE THE SCREWS. The screws only need to be loose to manually adjust cam.*

c. Push the Cam Control Box UP to rotate the cam. After the cam is adjusted in the proper direction, push the cam down to align with teeth. Refer to *Figure 4-7.*

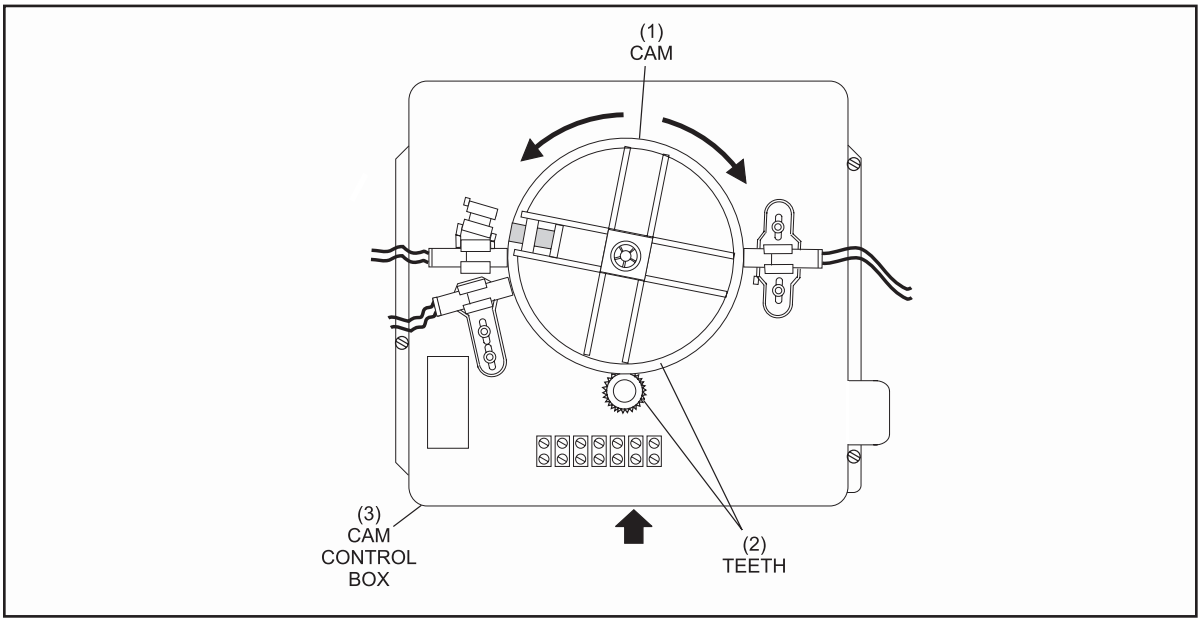


Figure 4-7. Raise & Lower Cam Control Box.

1 CAM 2 TEETH 3 CAM CONTROL BOX

d. Tighten the three screws from step b.

e. Turn the power on and cycle machine. Repeat Cam Adjustment until string wagon locks into stop dogs

Adjust String Tension

1. Adjust string tension.

   a. Lock the drive pulley in position.

   b. If pins won't come into the centering cone, go to step 5.

   c. Slide the string spool to the left away from locking pin. Refer to *Figure 4-8.*

NOTE: *Rotating the spool as arrow (4) shows will reduce the tension. Rotating the spool as arrow (3) shows will increase the tension. Refer to* Figure 4-8.

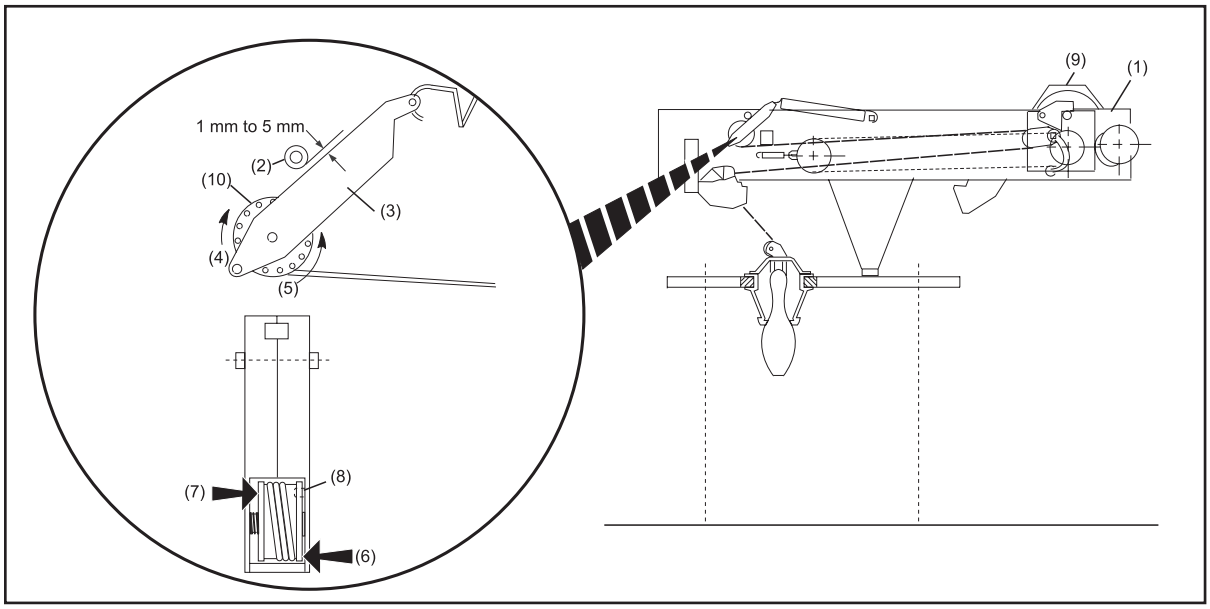


Figure 4-8. String Tension Adjustments

1. PINSETTER CYCLED TO PINS UP POSITION
2. LIMITER BAR
3. TENSION LEVER
4. TURN AS ARROW SHOWS TO INCREASE TENSION
5. TURN AS ARROW SHOWS TO DECREASE TENSION
6. AWAY FROM LOCKING PIN
7. TOWARD LOCKING PIN
8. LOCKING PIN
9. LARGE DRIVE PULLEY
10. SPOOL

   d. Rotate the string spool as required to obtain a gap of 0-1 mm between the limiter bar and the tension lever. Refer to *Figure 4-8.*

   e. When the proper gap has been obtained, move the string spool to the right and rotate it as required to align one of it holes with locking pin. Refer to *Figure 4-8.*

NOTE: *The string for the pins will stretch over time. This adjustment will have to be checked after the string has stretched.*

Pin Detection Adjustment

1. The fallen pin detection is an adjustment that is seldom needed. This adjustment allows the pin down reed switch to identify a pin if it has fallen from the bowling ball. If this adjustment is incorrect it could identify a pin that was moved off spot, but did not fall.

The recommended sensitivity adjustment level setting is 10. The gears are marked every fifth tooth with numbers 1, 5, 10, and 15.

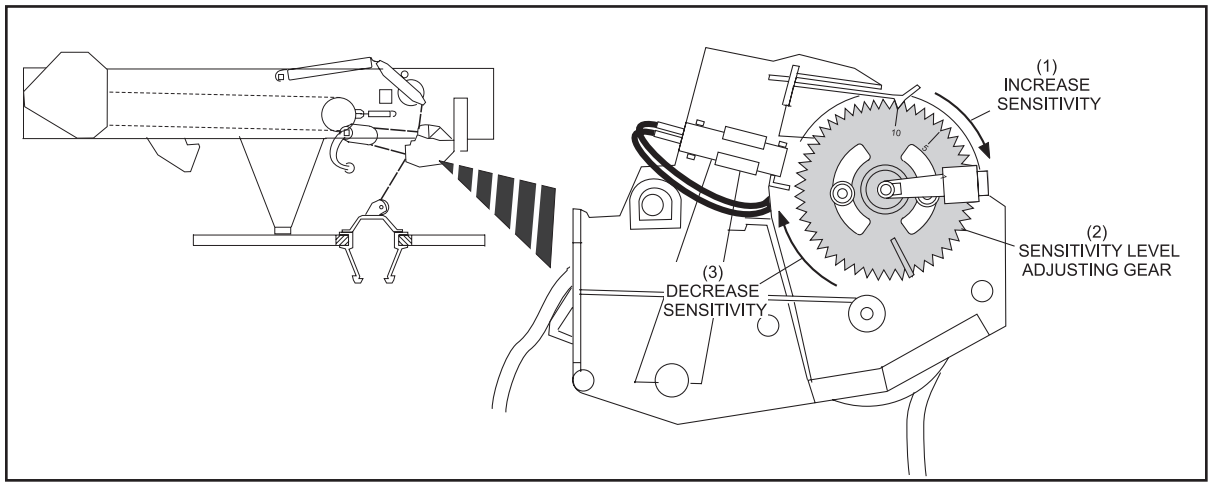


Figure 4-9. Adjust Sensitivity

1. INCREASE SENSITIVITY
2. SENSITIVITY LEVEL ADJUSTING GEAR
3. DECREASE SENSITIVITY

a Fallen pin is detected

- The magnet on the spic is to identify when a pin has fallen. When a pin has fallen the magnet is in line with the reed switch.

NOTE: *The magnet is in line with the reed switch ONLY during the frame when the pin has fallen and lying on the pin deck*

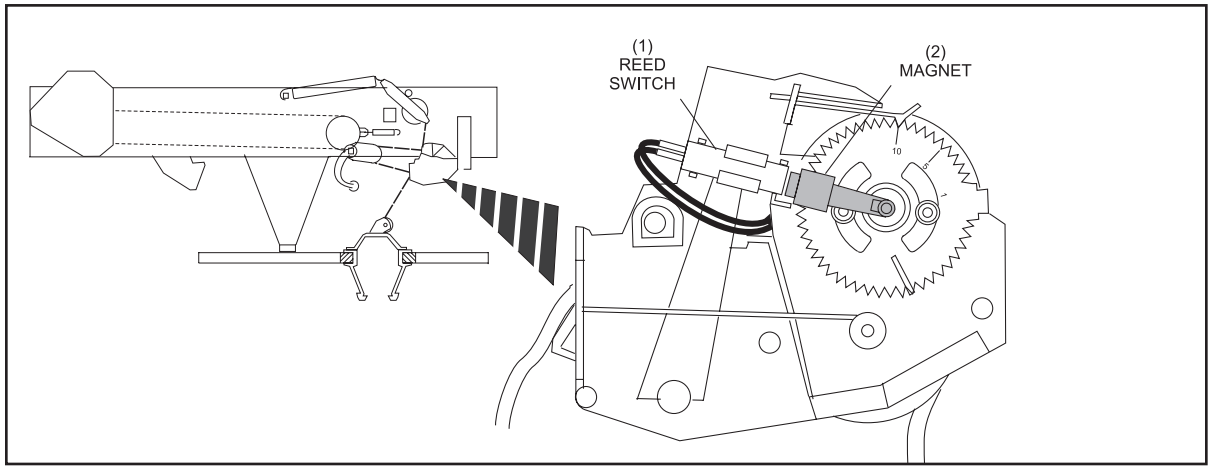


Figure 4-10. Reed Switch Position

1. REED SWITCH
2. MAGNET

b. Fallen pin is NOT detected

- The magnet is not in line with the reed switch. There is not a certain position the magnet stays in. As long as the magnet is not in line with the reed switch.

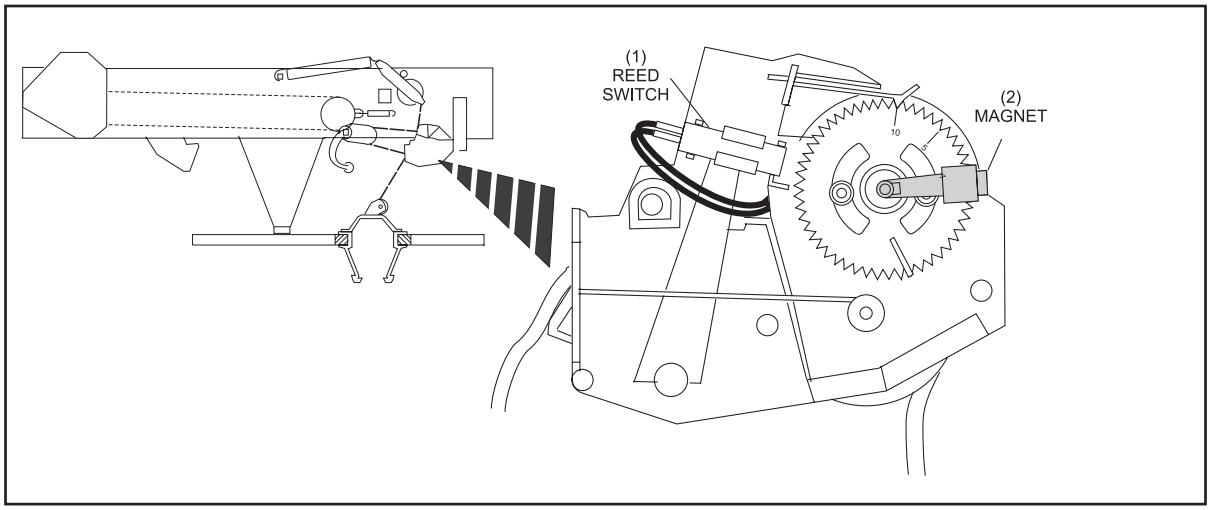


Figure 4-11. Magnet Position

1. REED SWITCH
2. MAGNET

NOTE: *TROUBLE SHOOTING TIP Sometimes the reed switch will provide a false signal because the magnet becomes stuck or caught and stays on the reed switch. To correct this issue, verify the magnet is not broken and rotate magnet away from the reed switch.*

Pin Slow Setting Adjustments

1. Turn the pinsetter power on. Knock down some pins. When the string wagon travels to the rear of the string pinsetter, turn off the pinsetter power
2. With the pinsetter power off, lock out the power
3. The pins will travel to the pindeck by gravity

Warning! Pinsetter power is to remain off while performing any manual function.

4. Manually rotate the large drive pulley in reverse, raising the pins 1-3, until the string wagon lever roller starts to touch the pin slow setting cam.
5. Lock the large drive pulley at this position
6. Measure the distance the bottom of pins 1-3 & 5 are from the pin deck. The distance should be 60 mm +-20 mm. Measure the distance the bottom of pins 4, 6 and 7-10 are from the pin deck. The distance should be 80 mm +- 20 mm.

7. If the distance is greater than 80 mm or 100 mm adjust the pin slow setting cam forward. If the distance is less than 40 mm or 60 mm adjust the pin slow setting rearward.

NOTE: *The before and after position of the cams must be the same on both sides of the machine.*

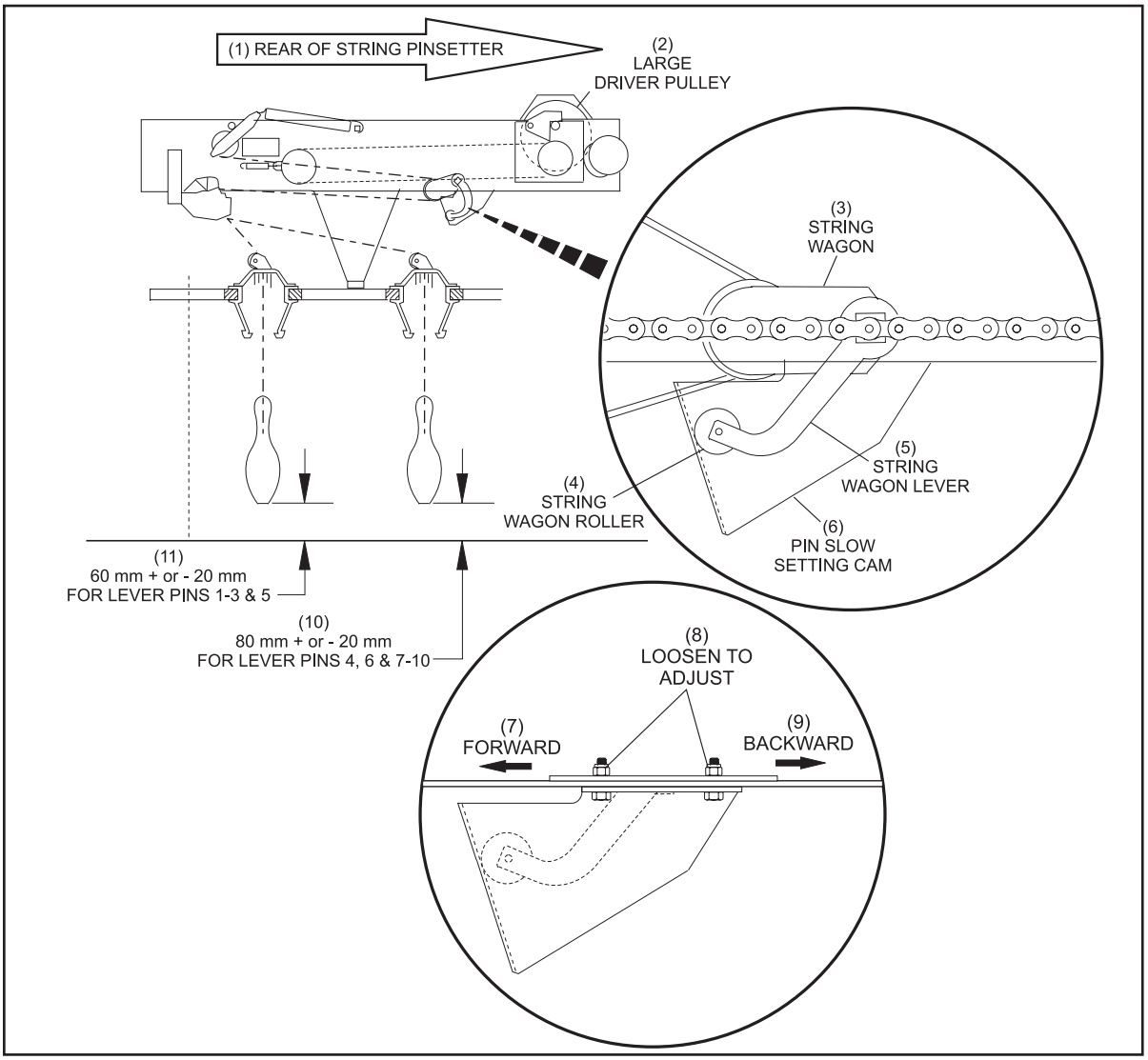


Figure 4-12. Slow Setting Adjustment

1. REAR OF STRING PINSETTER
2. LARGE DRIVE PULLEY
3. STRING WAGON
4. STRING WAGON ROLLER
5. STRING WAGON LEVER
6. PIN SLOW SETTING CAM
7. FORWARD
8. LOOSEN TO ADJUST
9. BACKWARD
10. 80 mm + OR - 20 mm FOR LEVER PINS 4, 6 AND 7-10
11. 60 mm + OR - 20 mm FOR LEVER PINS 1-3 AND 5

String Brake Adjustments

1. To operate the stringpin pinsetter in stand alone mode with the stringpin pinsetter ball detect (not the Vector ball detect) the “EIN” connector must have the “+24” and the “ON/OFF” terminals jumper.

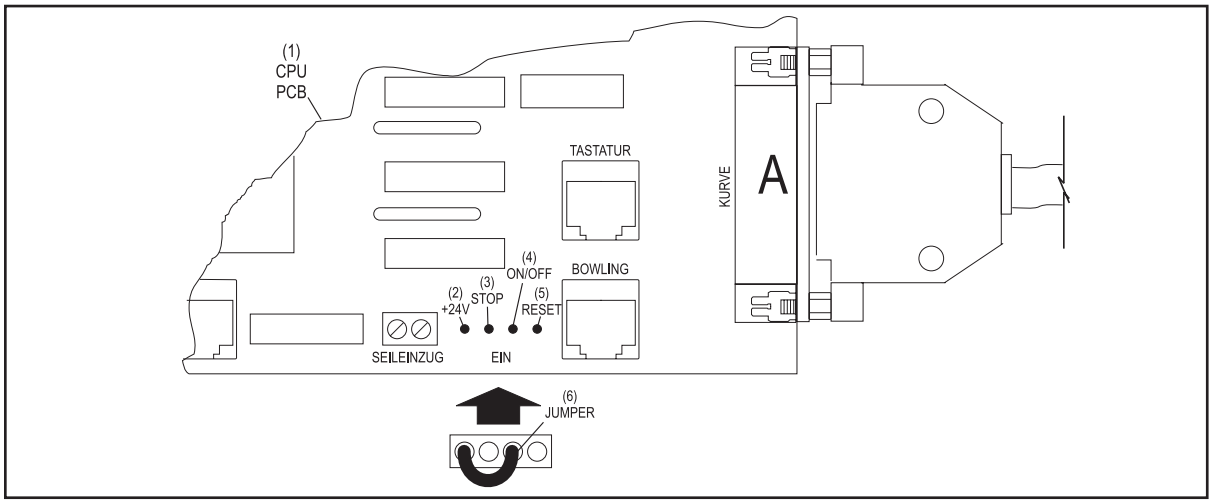


Figure 4-13. Stand Alone Mode

1. CPU PCB
2. +24V
3. STOP
4. ON/OFF
5. RESET
6. JUMPER

2. Adjust the stringpin pinsetter ball detect before next step.

3. With the pinsetter power on, knock over some pins. The machine will cycle and should keep the knocked over pins in the up position.

4. Turn the pinsetter power off and lockout the power on/off switch.

Warning! Pinsetter power is to remain off while performing any manual function.

5. Check the movement of the pin in the pin centering cone by pulling on the string. The travel of the pin movement should be 80 mm ± 20 mm. Refer to *Figure 4-14*.

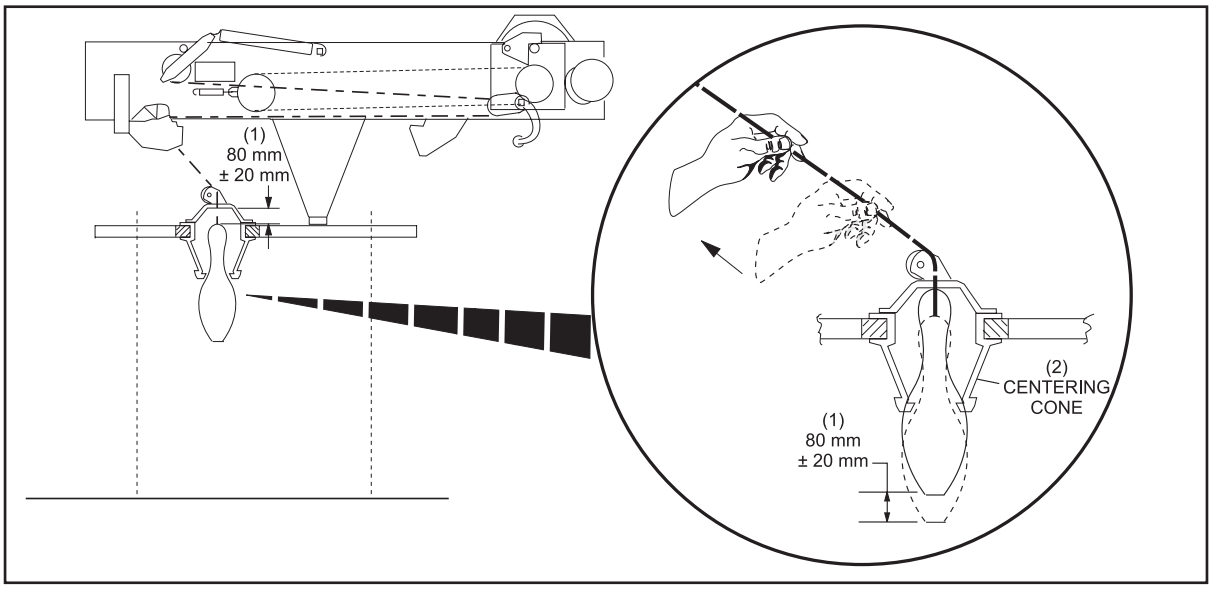


Figure 4-14. String Brake Adjustment

1. 80 mm ± 20 mm
2. CENTERING CONE

6. If travel is greater than 100 mm, move the string brake switch up. Refer to *Figure 4-15.*

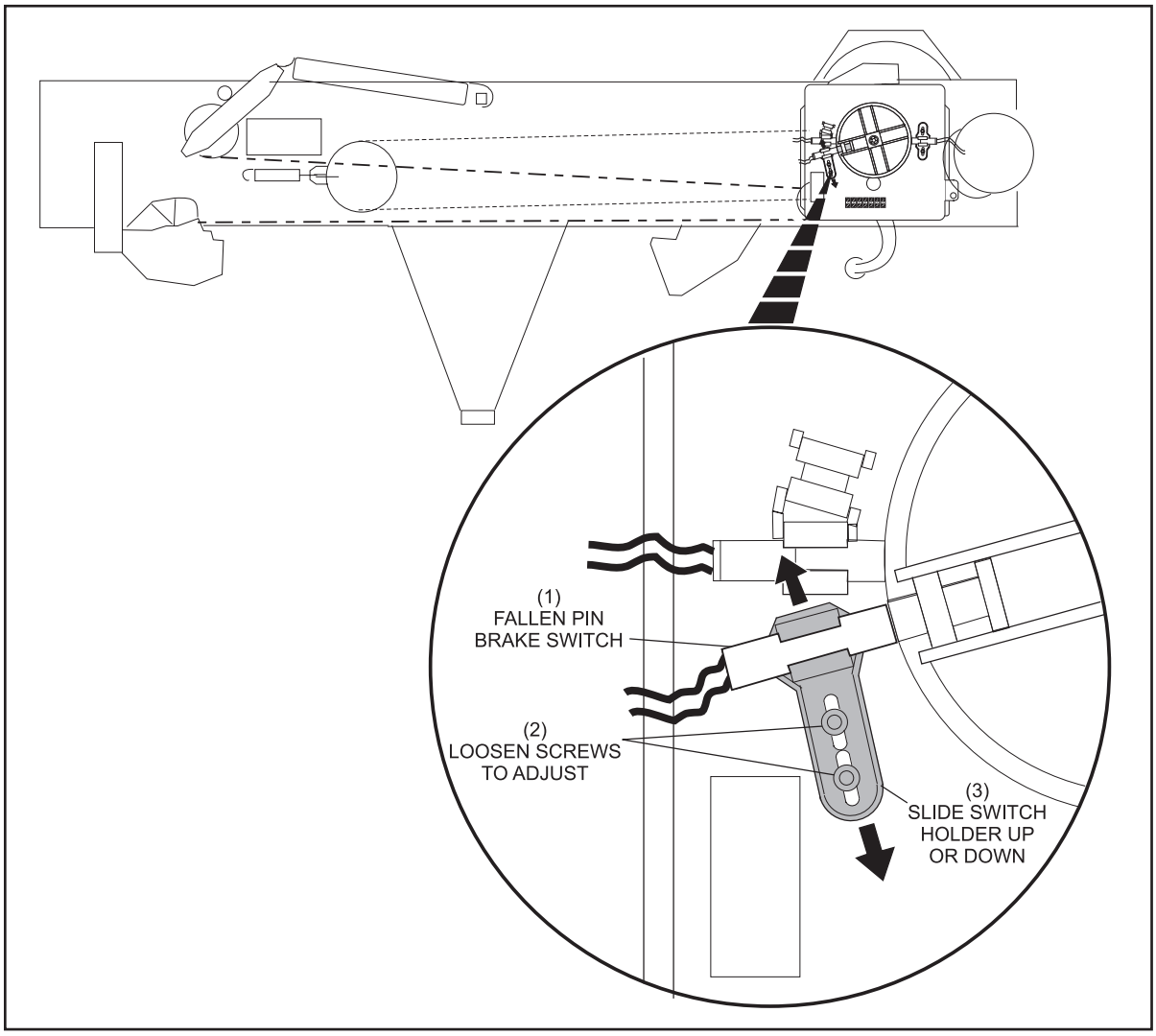


Figure 4-15. Adjust Brake Switch

1. FALLEN PIN BRAKE SWITCH 2. LOOSEN SCREWS TO ADJUST 3. SLIDE SWITCH HOLDER UP OR DOWN

7. If the travel is less than 60 mm, move the string brake switch down.

8. Repeat steps b-e to verify pin movement in pin centering cone.

Adjust Home Switch.

The Home Switch is adjusted to allow the pins to set on the pindeck and to limit the pins from going into the ball door and breaking the ball detect beam.

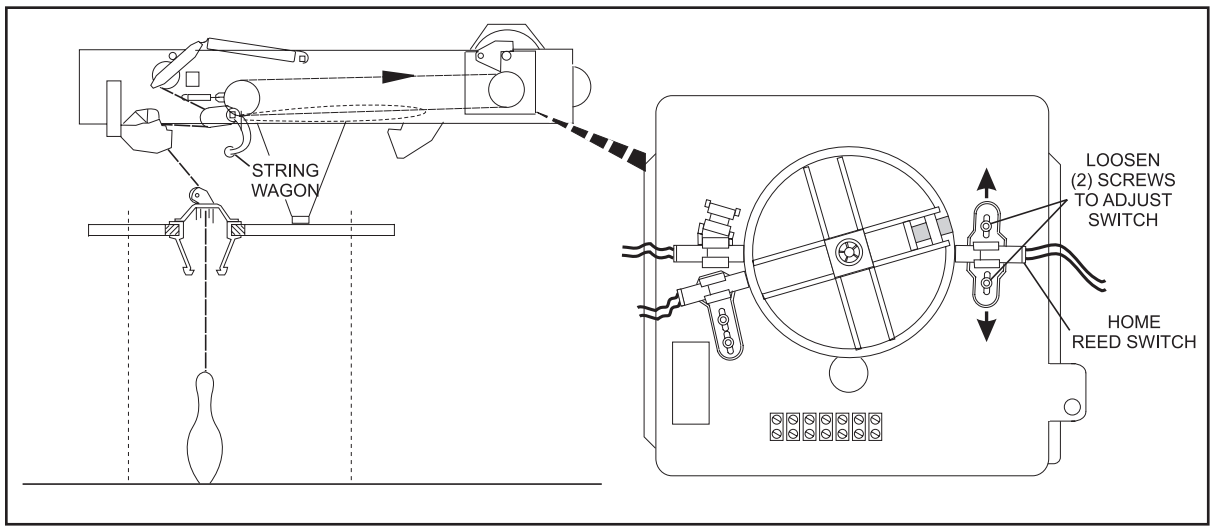


Figure 4-16. Home Switch Adjustment

1. Cycle the pins so all 10 pins are on the pindeck.

2. Check the position of the string wagon. It should stop in front of the front string wagon pulley.

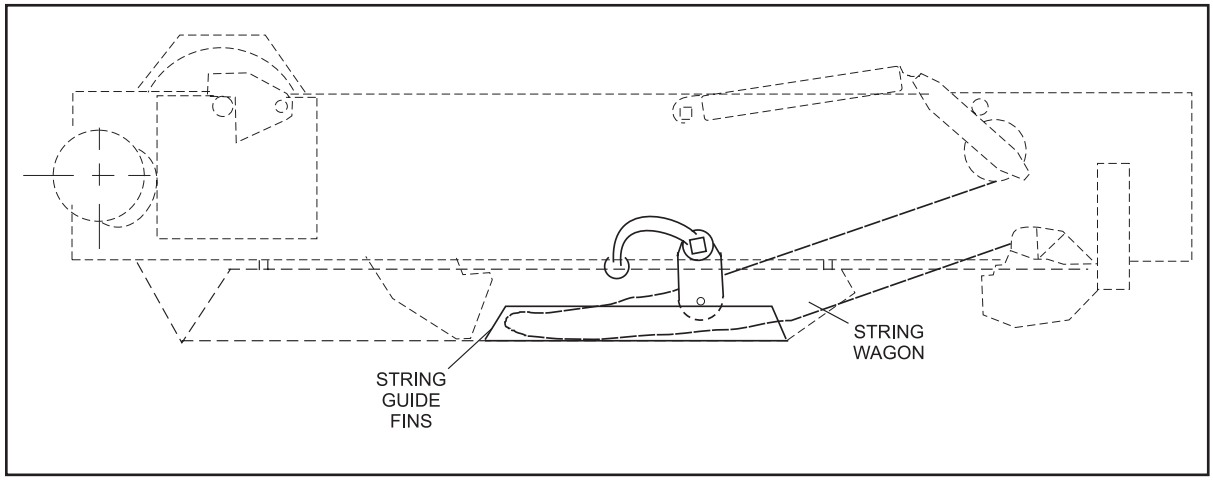


Figure 4-17. String Wagon Position

Section 5 - Maintenance & Service

MAINTENANCE

WARNING! When performing any maintenance, make sure the main power is turned off and the power plug has been disconnected.

Rotating Pins

NOTE: *Pins should be inspected once a week.*

Rotating pins in the 1 through 10 positions is necessary for long life of bowling pins .The rotation sequence of the bowling pins will depend on the bowling center and bowlers.

Pin Strings

Pin String Inspection and Repairing Worn String

NOTE: *Strings should be inspected at least once a week.*

Check the strings for wear, paying particular attention to the area at the head of the pin. If worn, remove the section of string by performing the following steps in "New String Installation" section.

WARNING! To avoid burning your hands wear gloves and use a rag to taper the melted string end.

1. Thread the string through the head of the pin and tie a knot in the end of the string. Leave approximately 1/2" (13 mm) of string extending beyond the end of the knot. Refer to *Figure 5-1.*

2. Pull the string back through the pin until the knot bottoms out in the pin. Refer to *Figure 5-1.*

3. Adjust the string tension for any pin where the string has been cut, and pin installed.

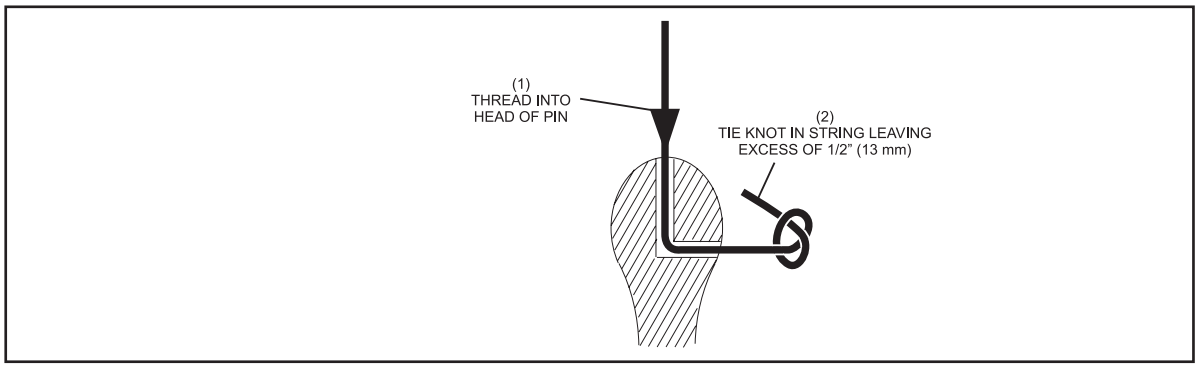


Figure 5-1. Thread String Through Pin

1 THREAD STRING INTO HEAD OF PIN

2 TIE THE KNOT IN STRING LEAVING EXCESS OF 1/2" (13 mm)

New String Installation

To control the way the pins are lowered to the pin deck, a limiting bar is installed between the pinsetter side frames. The strings for pins 4, 6, and 7 through 10 go over the limiting bar. The strings for pins 1 through 3 and 5 do not go over the limiting bar. Refer to *Figure 5-2.*

1. Cycle the pinsetter to first ball with ten pins on the pin deck.

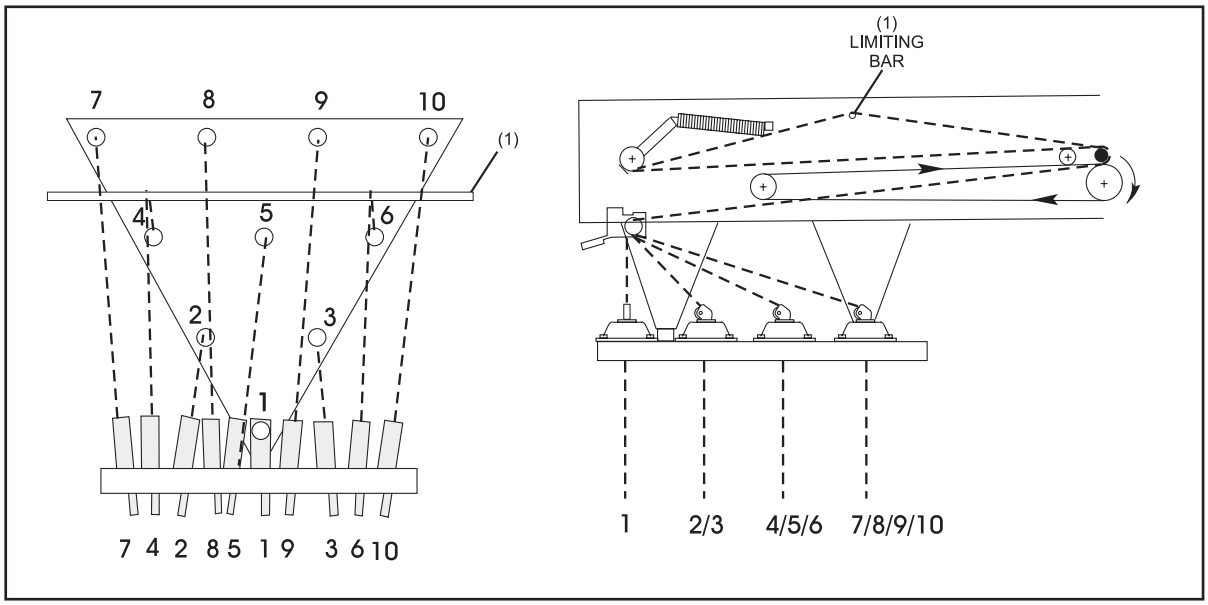


Figure 5-2. String Paths

1 LIMITING BAR

Warning! Pinsetter power is to remain off while performing any manual function.

2. Cut the string off any pin being replaced, just above its head. Refer to *Figure 5-3.*

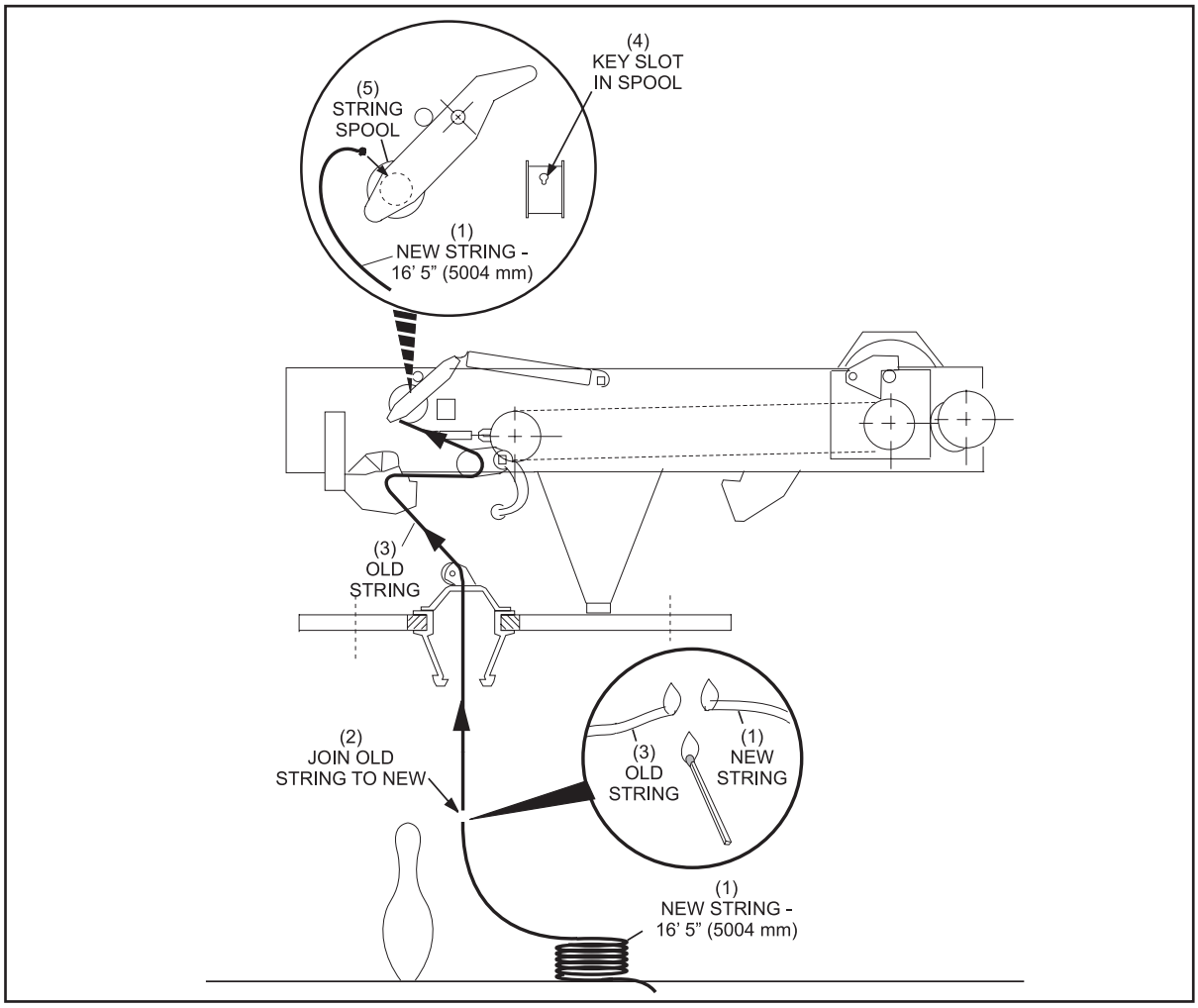


Figure 5-3. Restring Machine

1 NEW STRING - 16' 5" (5004 mm)	2 JOIN OLD STRING TO NEW	4 KEY SLOT IN SPOOL
	3 OLD STRING	5 STRING SPOOL

3. From a spool of replacement string, cut off a piece 16` 5" (5004 mm) long for each pin having its string replaced.

4. Cut end of the old string and one end of the new string. Melt string by making sure there is a flame on each end of the string, while the string ends are still hot, press them together and hold until they cool and form a joint. Cover the joint with electrical tape to increase its strength. Refer to *Figure 5-3.*

5. Thread the new string up to the spool by carefully pulling up the old string until the new string is at the string spool. Remove the tape at the joint between the old and the new string. Cut off and discard the old string. Refer to *Figure 5-3.*

6. Remove the old string from the spool. Tie a knot in the end of the new string. Slide the knot through the key slot in the spool shaft and secure it. Refer to *Figure 5-3.*

7. Secure the string to the pin, following the procedure detailed in *"String Inspection and Repairing Worn String".* in the *"Pin Strings"* section..

8. Wind the extra string onto the spool by rotating the spool as arrow (3) shows in *Figure 5-3*.

9. Adjust the spring tension for each new string, following the String Tension Adjustment.

LUBRICATION

Routine

Regular lubrication of the machine is necessary for a long machine life and good performance. The interval should be appropriate for the amount the machine is used. The more the machine is used, the more frequently it should be serviced.

- Every moving machine part should be lubricated from time to time.
- Every working part such as drive gears and drive chains, require more maintenance than low load parts.
- For large parts such as drive gears and chain sprockets, grease is the best lubricant
- For small parts, oil should be used.

Weekly (Every Week)

Rotating Pins

NOTE: *Pins should be inspected ounce a week.*

Rotating pins in the 1 through 10 positions is necessary for long life of bowling pins .The rotation sequence of the bowling pins will depend on the bowling center and bowlers.

Pin Strings

Pin String Inspection and Repairing Worn String

NOTE: *Strings should be inspected at least once a week.*

Check the strings for wear, paying particular attention to the area at the head of the pin. If worn, remove the section of string by performing the following steps in “New StringPin Installation” Manual.

WARNING! To avoid burning your hands wear gloves and use a rag to taper the melted string end.

Quarterly (3 Month)

- Apply grease to the chain with a paint brush to lubricate the chain`s exterior. Refer to *Figure 5-4*

- Lubricate the chain with oil. This oil will penetrate chain links to lubricate the chain's interior. Refer to *Figure 5-4.* .

- Apply oil to the pivot point where the string wagon is attached to the chain. Refer to *Figure 5-4*

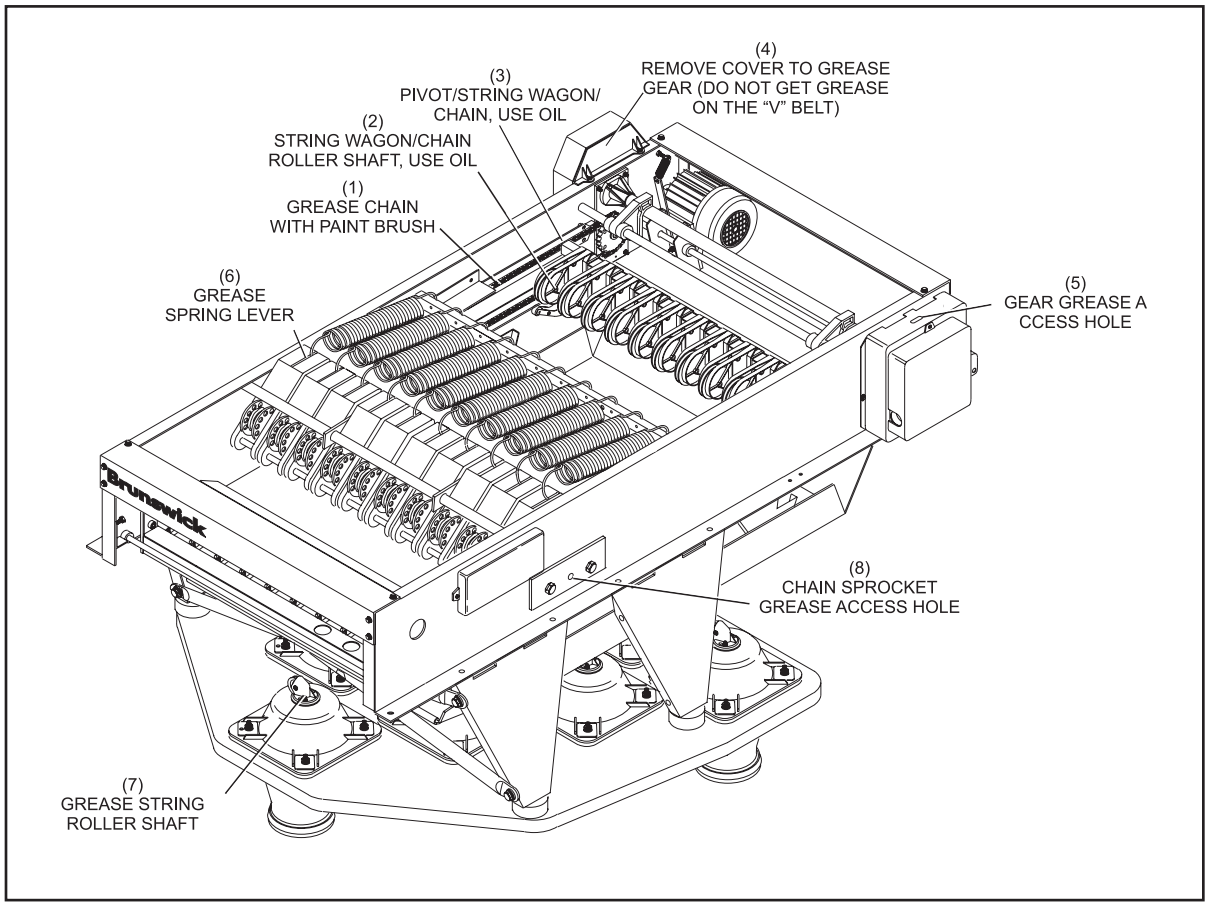


Figure 5-4. Lubrication Locations

1 GREASE CHAIN WITH PAINT BRUSH
2 STRING WAGON / CHAIN ROLLER SHAFT, USE OIL
3 PIVOT / STRING WAGON / CHAIN. USE OIL
4 REMOVE COVER TO GREASE GEAR (BE CAREFUL NOT TO GET GREASE ON THE "V" BELT)
5 GEAR, GREASE ACCESS HOLE
6 GREASE SPRING LEVER
7 GREASE STRING ROLLER SHAFT
8 CHAIN SPROCKET, GREASE ACCESS HOLE

Semi Annually (6 Month)

- Grease through hole in switch cluster over located on the right side of the rear of the pinsetter. Refer to *Figure 5-4.*

- Remove cover from the motor and gear assembly located on the left side of the rear of the machine and grease gear. Refer to *Figure 5-4.*

- Press grease in chain gears through hole in plate located on the outside of pinsetter frame adjacent to gear. Refer to *Figure 5-4.*

Annually

- Apply grease to the string roller shaft. Refer to *Figure 5-5.*

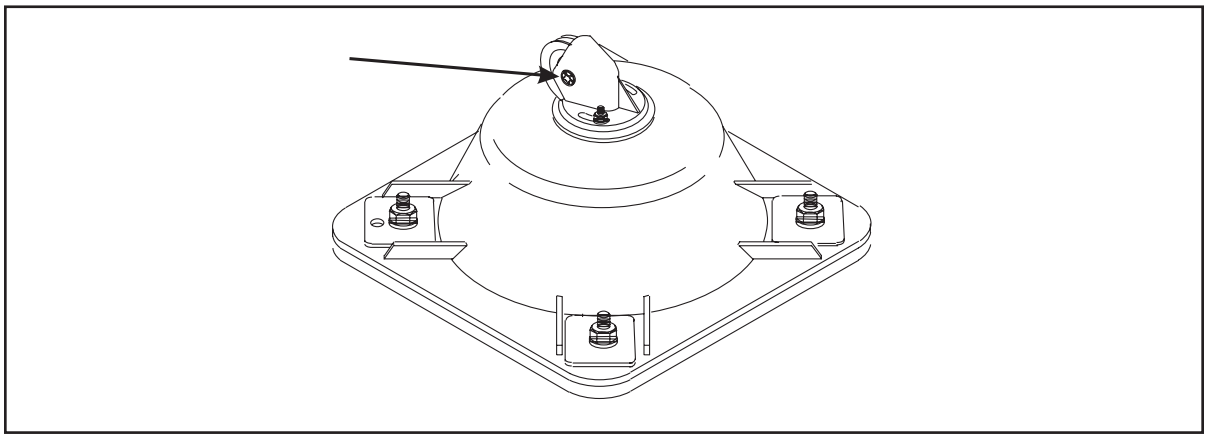


Figure 5-5. Grease String Roller

- Apply grease to the string lever with a paint brush. Refer to *Figure 5-6.*
- Apply a drop of oil on each side of the string lever. Refer to *Figure 5-6.*

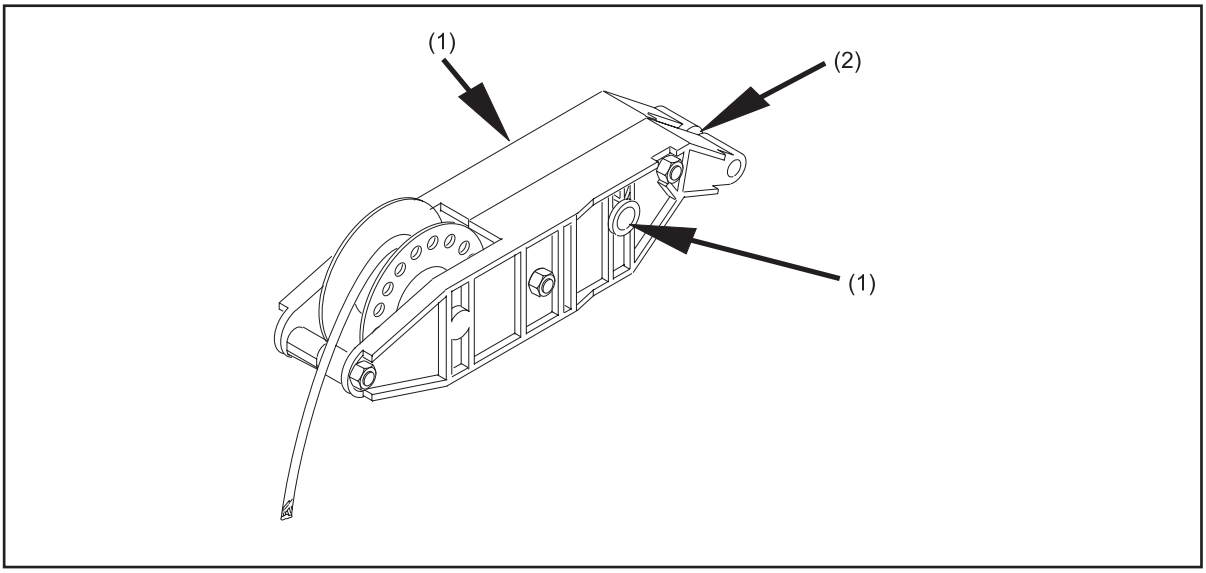


Figure 5-6. Grease String Lever With Paint Brush

1 OIL
2 GREASE

- Apply a drop of oil on each side of the string control units. Refer to *Figure 5-7.*

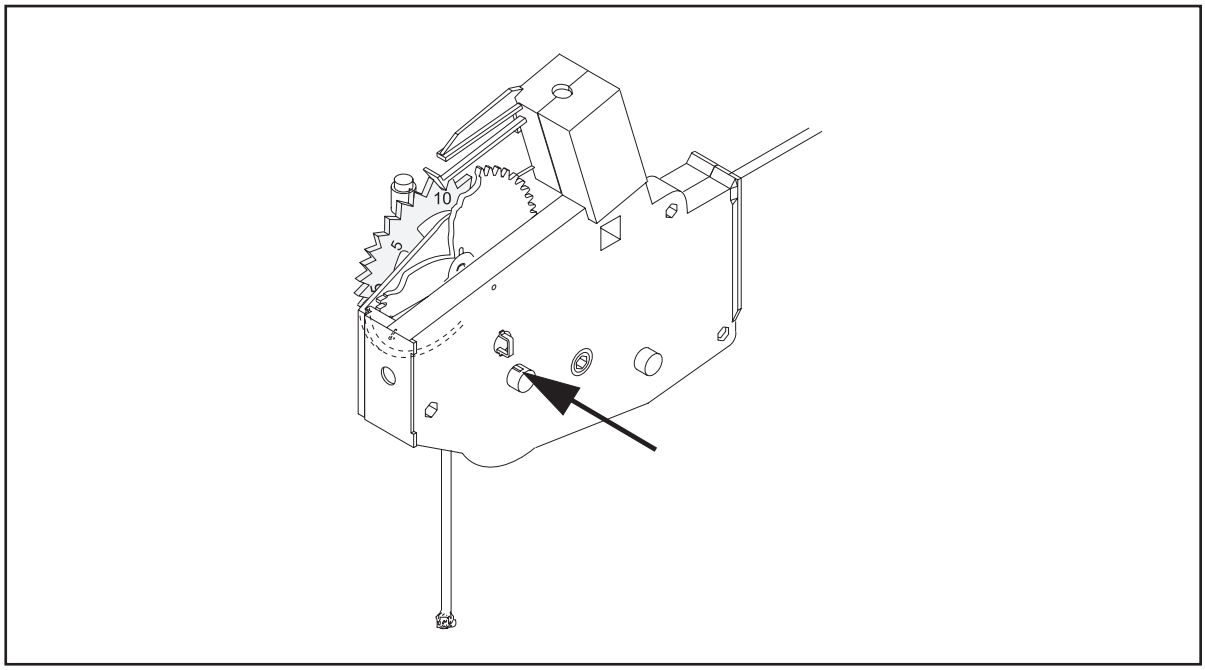


Figure 5-7. Oil String Control Unit

- Apply grease to the string wagon roller shaft and a drop of oil between the string wagon roller and the string wagon housings. Refer to *Figure 5-8*.

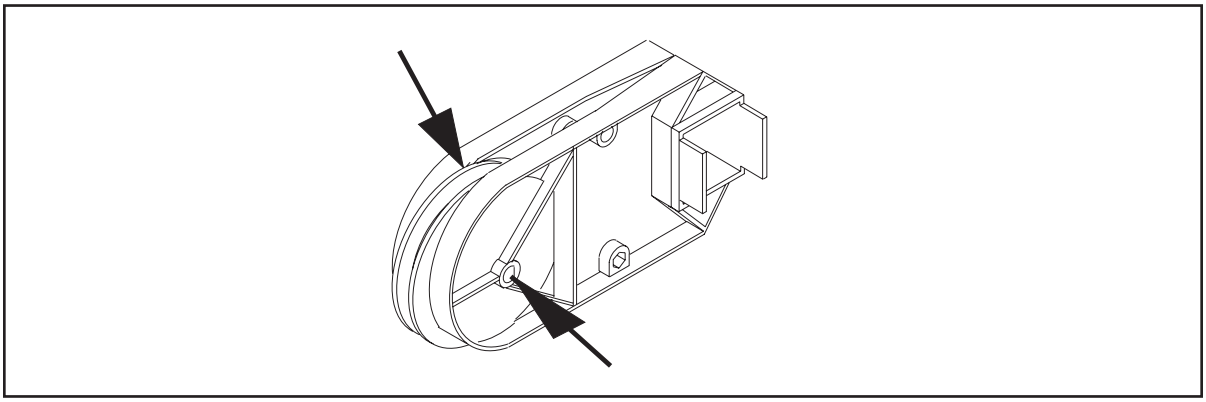


Figure 5-8. Oil & Grease String Wagon

Section 6 - Electrical

WIRING

Overview

See the following pages.

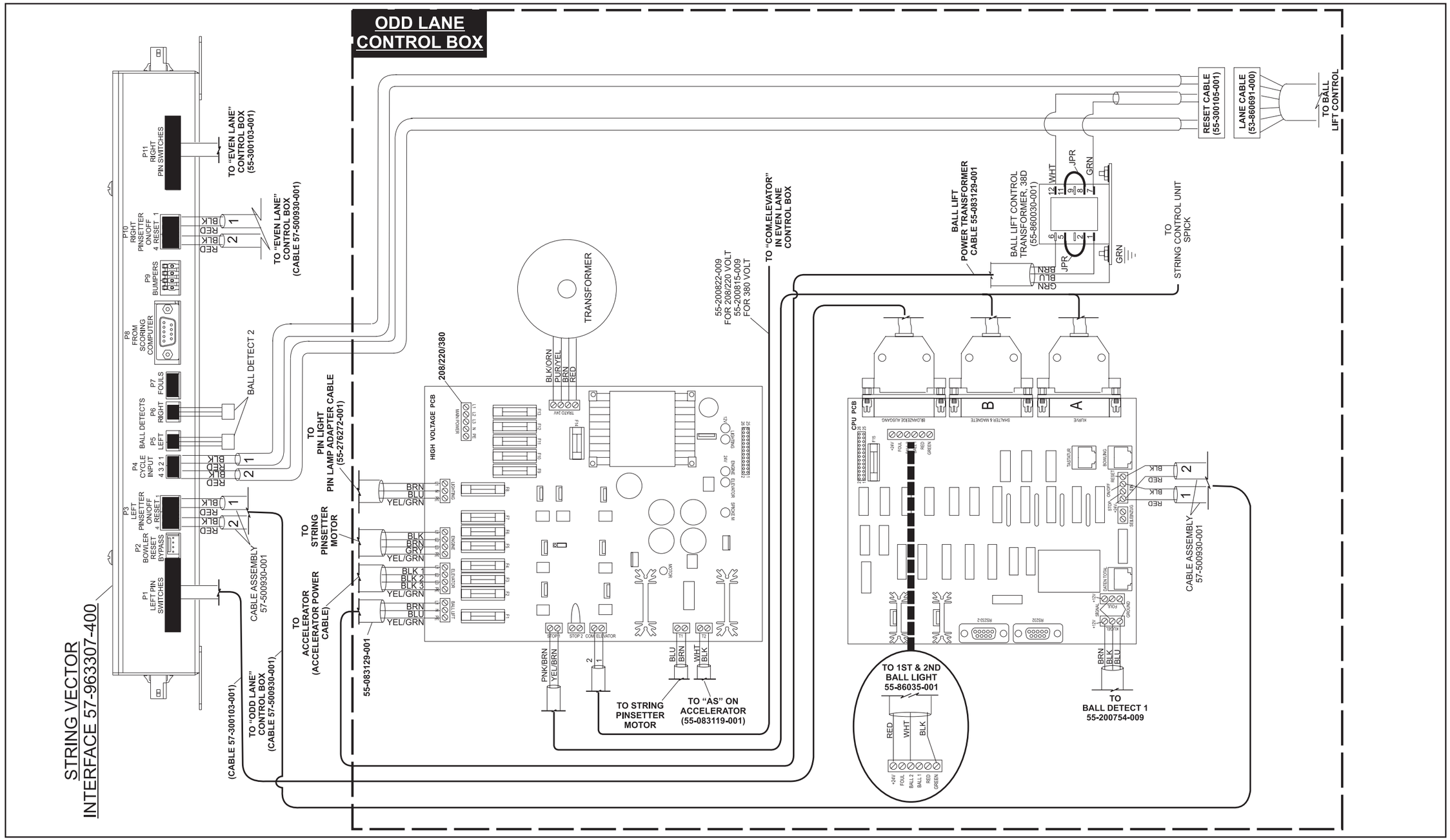


Figure7-1. Odd Lane Electrical Control Box

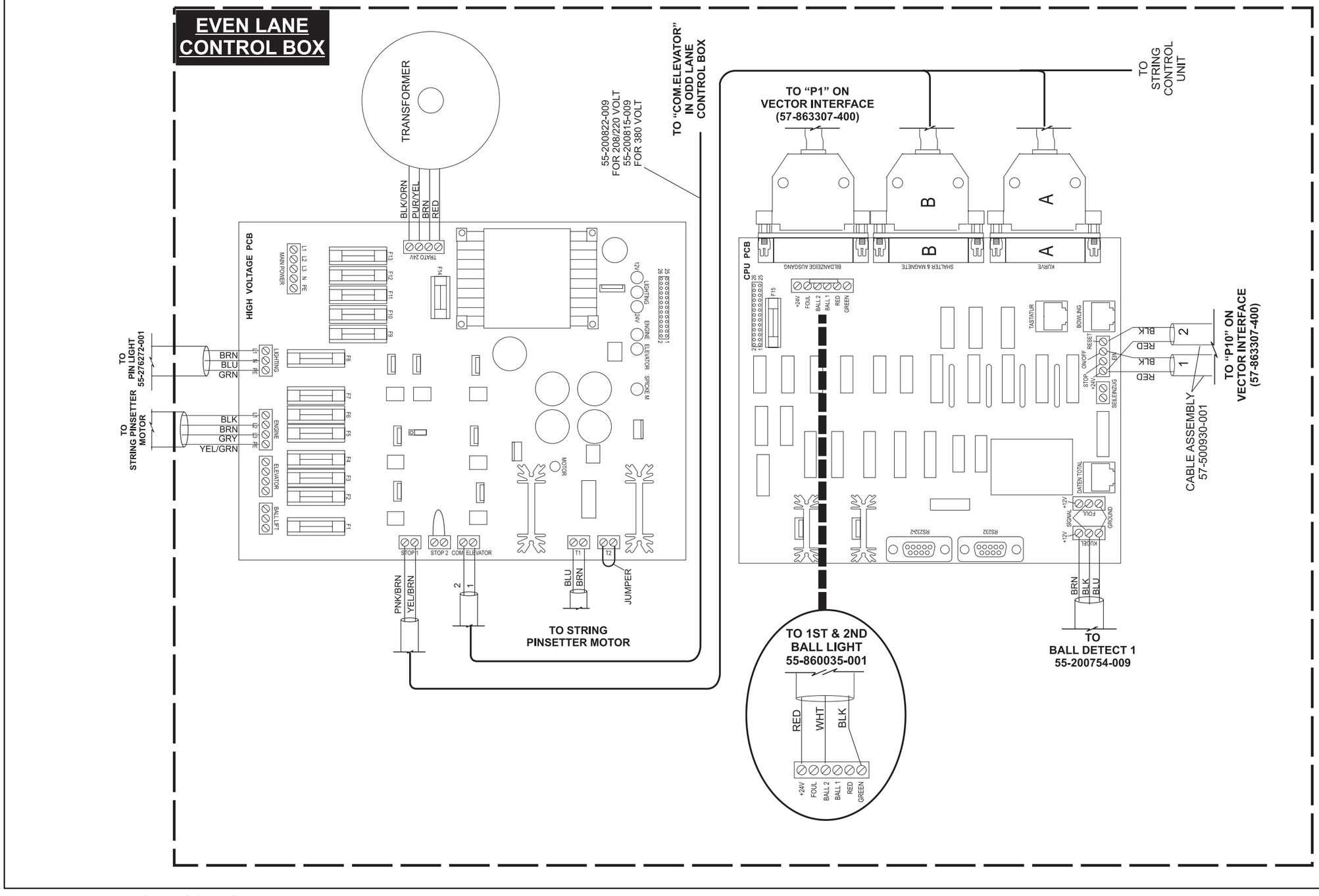


Figure 7-2. Even Lane Electrical Control Box

StringPin Controller PCB Components and Connections

String Pin High Voltage PCB

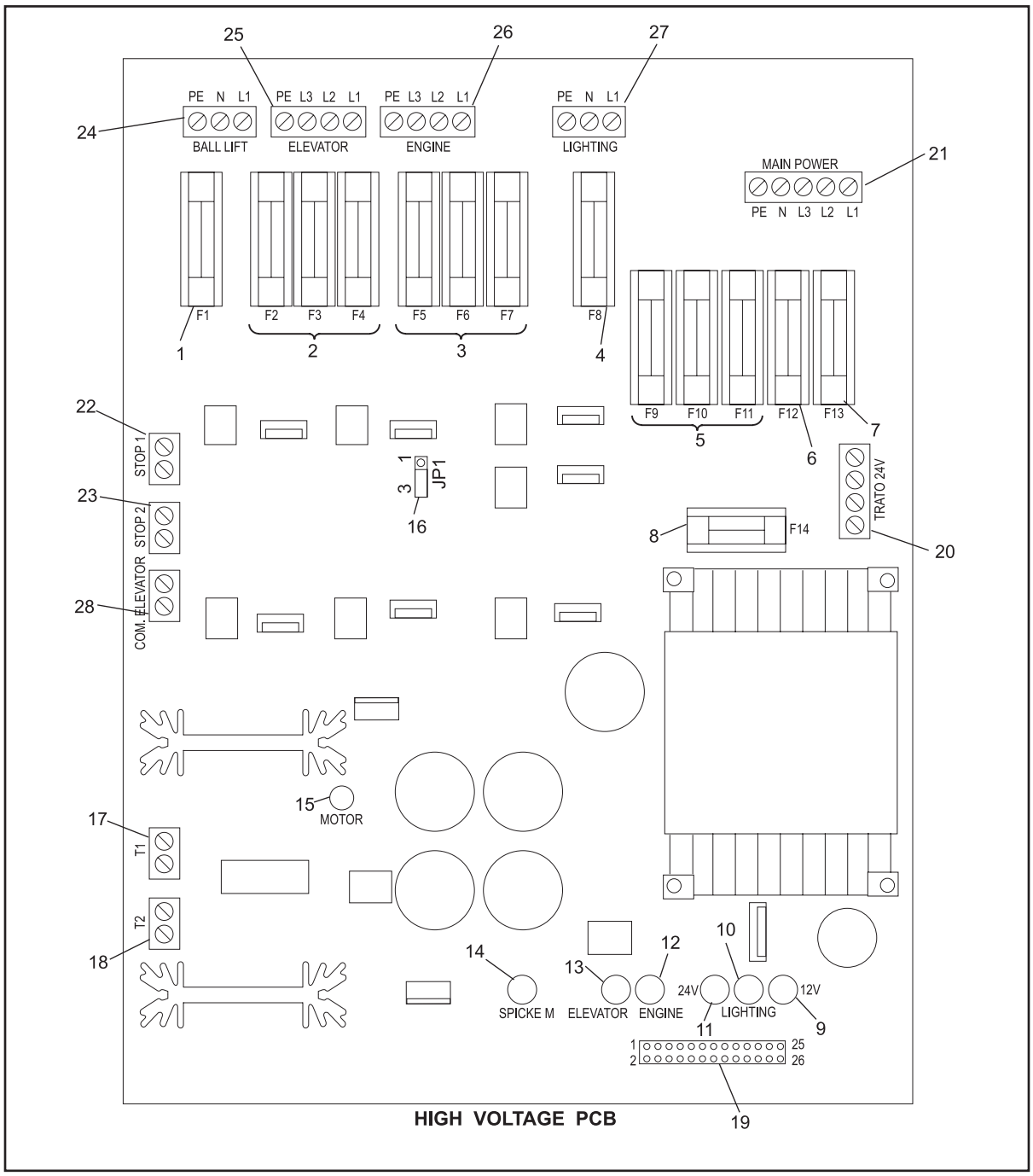


Figure 7-9. High Voltage PCB

The following is a description of the String Pin High Voltage PCB components and connections.

Fuses

(1) F1 - Fuse used to protect the ball lift relay from excessive current when turning the ball lift relay on. The fuse is rated at 250V 0.1A - fast blow.

(2) F2 – F4 - Fuses used to protect the accelerator from excessive current when turning the accelerator on. The fuse ratings for 380V power is 250V 1.6 A and for the 208/220V power is 250V 3.15 A - fast blow

(3) **F5 – F7 -** Fuses used to protect the string pinsetter motor from excessive current when turning the string pinsetter motor on. The fuse ratings for 380V power is 250V 1.6 A and for the 208/220V power is 250V 3.15 A - fast blow

(4) **F8 -** Fuse used to protect the pin light from excessive current. The fuse is rated at 250V 2.0 A - fast blow.

(5) **F9 – F11 -** Fuses used to protect the PC board from excessive current from the L1, L2, and L3 input power. The fuse ratings are 250V 4.0 A - fast blow

(6) **F12 -** Fuse used to protect the PC board from excessive current on the ground of the board. The fuse rating is 250V 0.5 A - fast blow

(7) **F13 -** Fuse used to protect the PC board from excessive current on the neutral of the board. The fuse rating is 250V 1.6 A - fast blow

(8) **F14 -** Fuse used to protect the PC board from excessive current on the 24V power line. The fuse rating 250V 10.0 A - fast blow

LED

(9) **12V LED -** This LED lights when the AC voltage for the 12 Volt circuitry is operating

(10) **Lighting (Pin Light) LED -** This LED lights when the voltage for the pin light circuitry is operating

(11) **24V LED -** This LED lights when the AC voltage for the 24 Volt circuitry is operating

(12) **Engine LED -** This LED lights when the voltage for the string pinsetter motor circuitry is operating

(13) **Elevator (Ball Accelerator) LED -** This LED lights when the voltage for the ball accelerator motor circuitry is operating

(14) **Spicke M LED -** Solenoid for brake on the SPIC

(15) **Motor CLEAR LED** - This LED is connected to T1 and T2 connectors. It will light if T1 or T2 has an open connection. The thermal overload protection of the accelerator and string pinsetter motors are usually connected to T1 and T2

Jumper

(16) JP1 - Jumper pins 1 & 2 for Kegal. Jumper pins 2 & 3 for bowling

Connectors

(17) **T1 -** The string pinsetter thermal protection is connected to this connector

(18) **T2 -** The accelerator thermal protection is connected to this connector

(19) **CON 26 -** Communication between the CPU and High Voltage PCB

(20) **Trato 24V -** This connects to the transformer to convert input power of 380/220/208 to 24 VAC for the PCB

(21) **Main Power -** Input power connection for the 3-phase power. This voltage can be 208, 220 or 380V AC.

(22) **Stop1** - There are 2 stop switches on the machine. They are connected to Stop 1 in series

(23) **Stop2** - If this connection is open the machine will not operate. We use a jumper to close this connection. This could be used with a stop switch if desired.

(24) **Ball-Lift -** This is a 24V AC supply for the ball lift relays. !NOTE: This is protect with at 250V 0.1A fast blow fuse.

(25) **Elevator (Accelerator) -** This provides three phase 380/220/208V power to the accelerator.

(26) **Engine -** This provides three phase 380/220/208V power to the string pinsetter motor

(27) **Light -** This provides single phase 220/208V power to the pin light.

(28) **Com Elevator (Accelerator) -** The odd and even control boxes of a lane pair are connected together at "Com Elevator". The accelerator and the bal lift are connected to the odd lane control box. This is used to communicate from the even lane control box to operate the accelerator and the ball lift.

String Pin CPU PCB

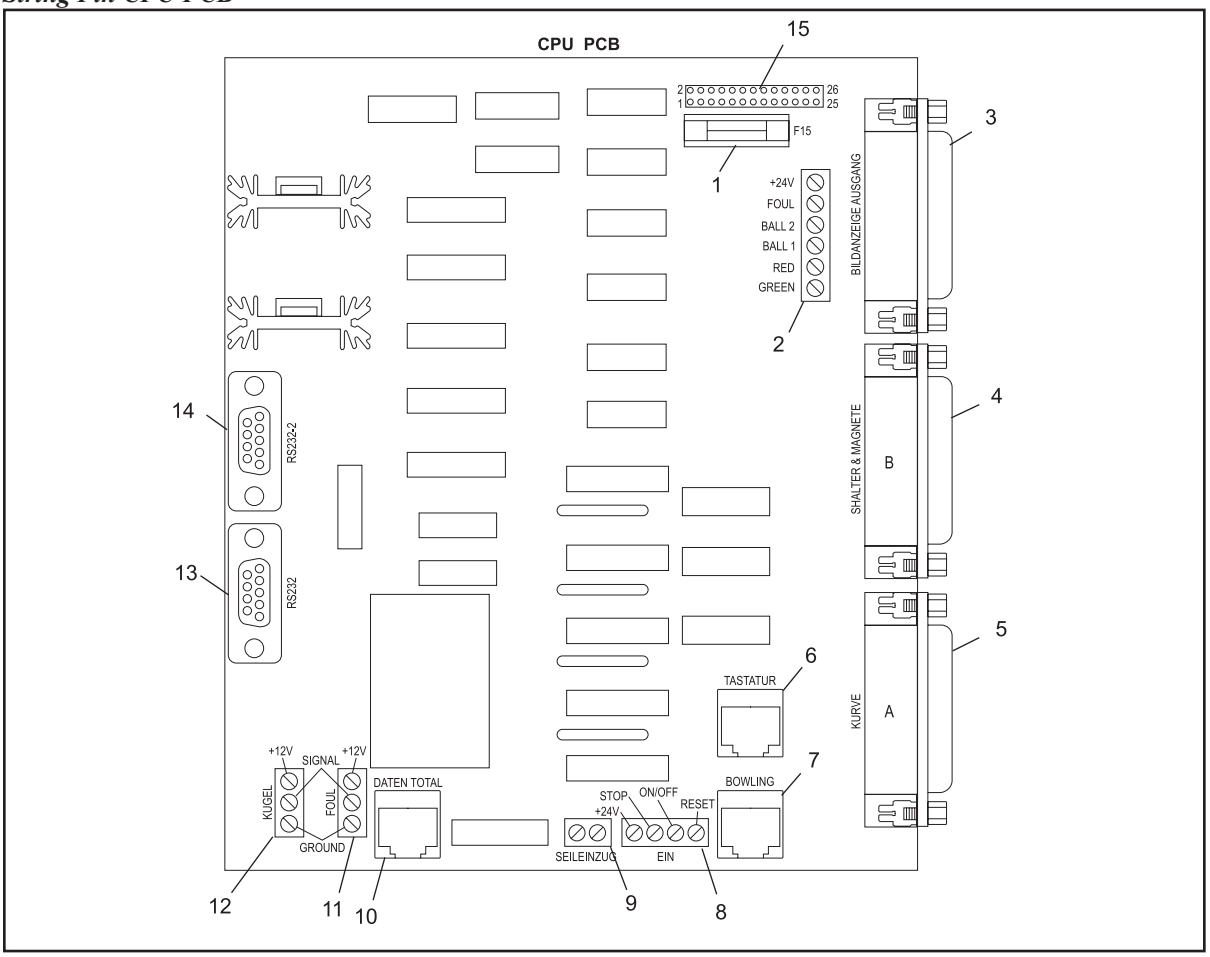


Figure 7-10. CPU PCB

The following is a description of the String Pin High CPU PCB components and connections.

Fuses

(1) F15 - Fuse used to protect the CPU PCB from excessive current from the 24VAC input power. The fuse rating is 250V 2.0 A - fast blow

Connectors

(2) CON 6 – Connection for the 1st and 2nd ball light

(3) BILDANZEIGE AUSGANG – Connection to the Vector Scoring String Pin Interface for the bowling pin status

(4) SHALTER & MAGNETE - SPIC reed & solenoid switches

(5) KURVE - Signals from CAM

(6) TASTER - NA

(7) Bowling – NA

(8) Ein - Connection to the Vector Scoring String Pin Interface to reset and turn the string pinsetter on/off

(9) Seileinzug – A push button is connected to toggle the pins up and down to adjust the tension of the string.

(10) Data Tota – NA

(11) Uebertr/Foul – NA

(12) Kugel – Ball detect connection

(13) RS232 - NA

(14) RS232 – 2 – NA

(15) CON 26 – Communication between the CPU and High Voltage PCB

Vector String Pinsetter Interface

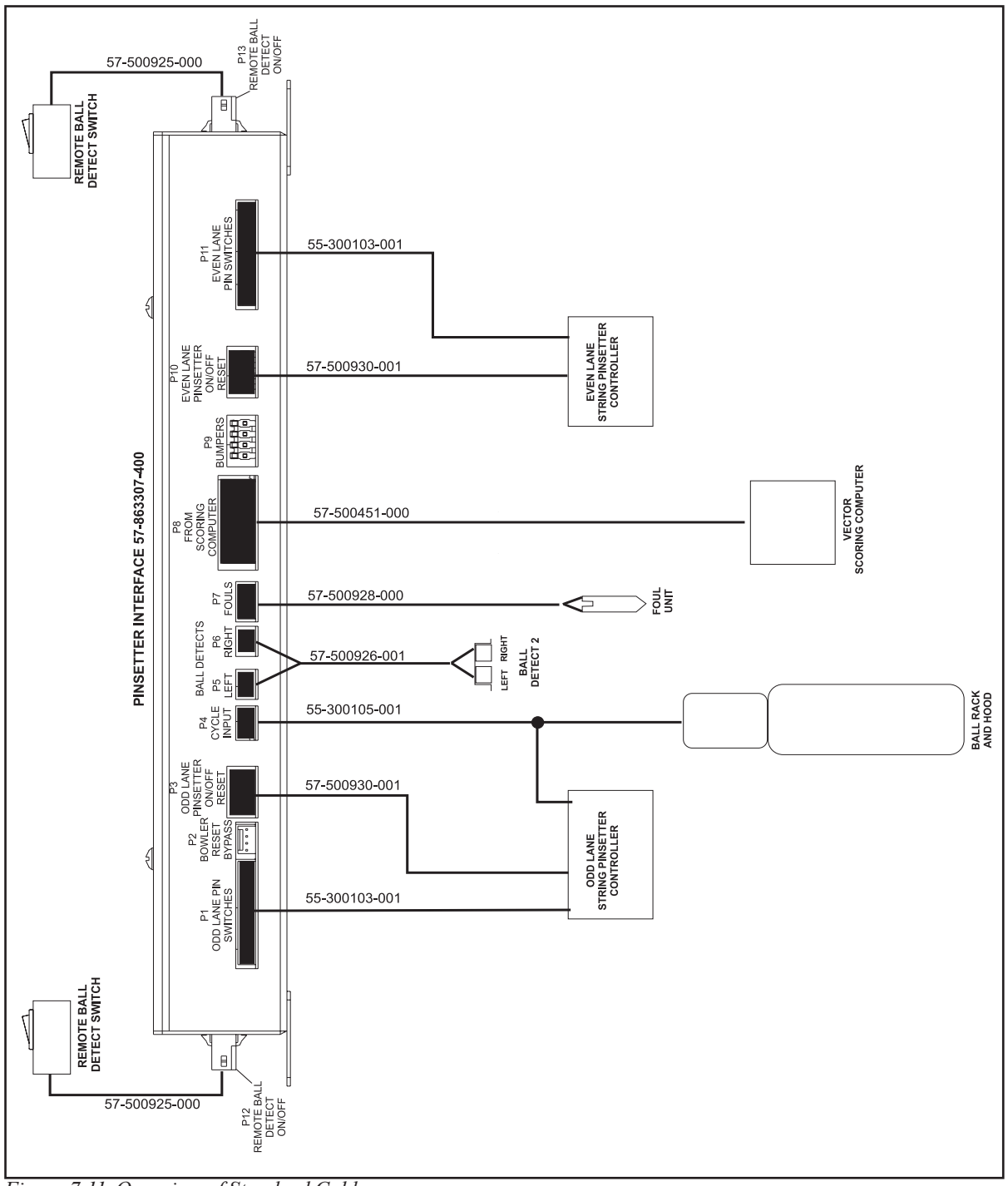


Figure 7-11. Overview of Standard Cables

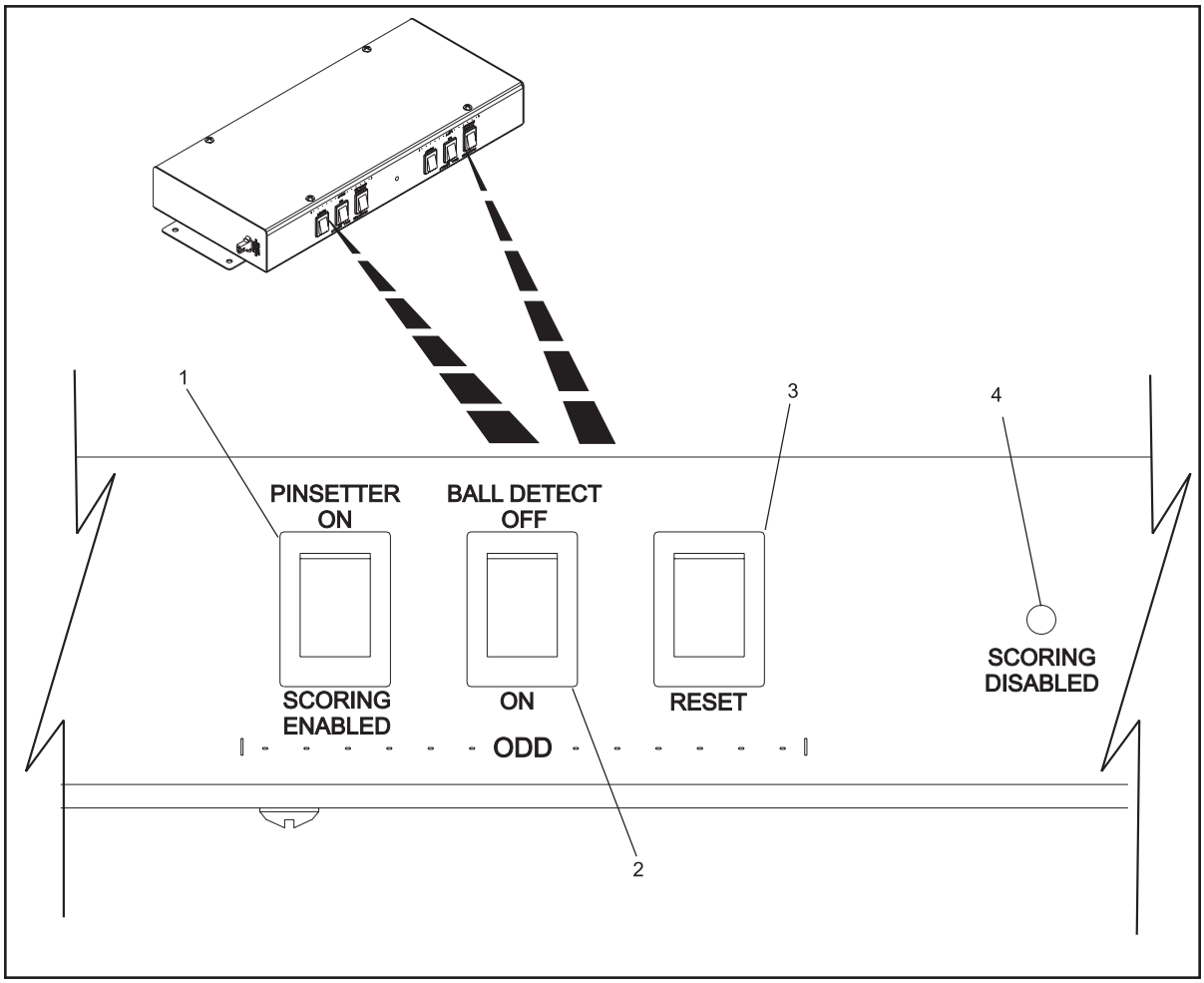


Figure 7-12. Overview of Buttons on Top of Interface

The following is a description of the pinsetter interface components and connections.

(1) **Pinsetter On/Scoring Enabled -** When in the "Scoring Enabled" mode, the pinsetter will cycle by the scoring system. When in the "Pinsetter On" mode there is no communication to the scoring system.

(2) **Ball Detect On -** Enables/disables the ball detects. When the ball detect is disabled, it will not record a ball passing. The disable function is for untangling pin strings or other service.

(3) **Reset -** Cycles the machine

(4) **Scoring Disabled -** Lit LED indicates "Pinsetter On" mode is enabled or "Ball Detect Off" is enabled

Figure 6-15. Route Reset Control Cable

PINSETTER INTERFACE CONFIGURATION

Refer to *Figure 41* and pages 45-48 for location and proper setting of JP4, JP5, and dipswitch S1

1. **Foul Jumper (JP4) -** Jumper used to configure the interface so that is can properly handle the foul input signal. When using Brunswick foul units or foul units that uses a relay type (switch) output, install a jumper to short the pins. If using a foul unit that supplies +12VDC as an output (AMF) remove the jumper.

2. **Ball Detect Jumper (JP5) -** Jumper used to configure the interface PCB to power the ball detectors with 5VDC or a 12VDC. For Vector ball detects set the jumper to 12VDC.

3. **Dipswitch S1 -** An eight position dipswitch used to configure the interface.

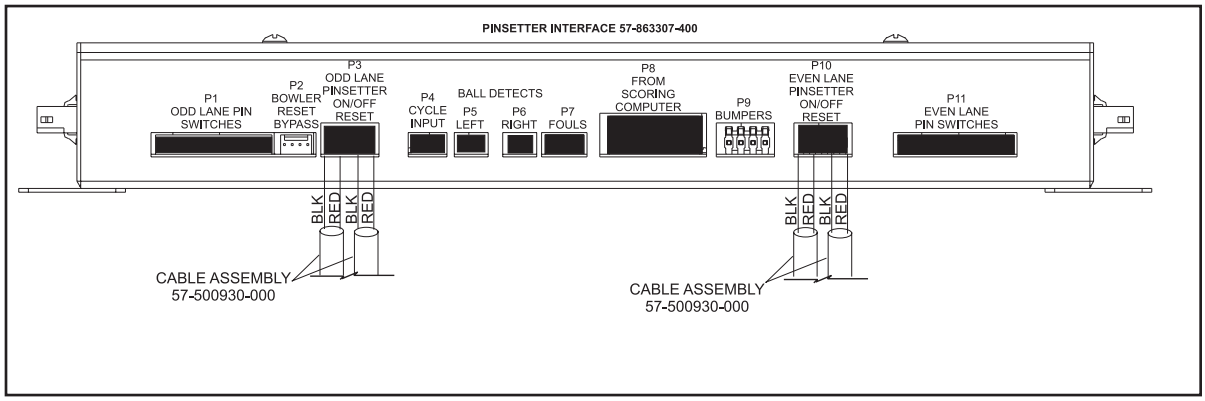


Figure 7-13. Interface Configuration

Vector Interface PCB

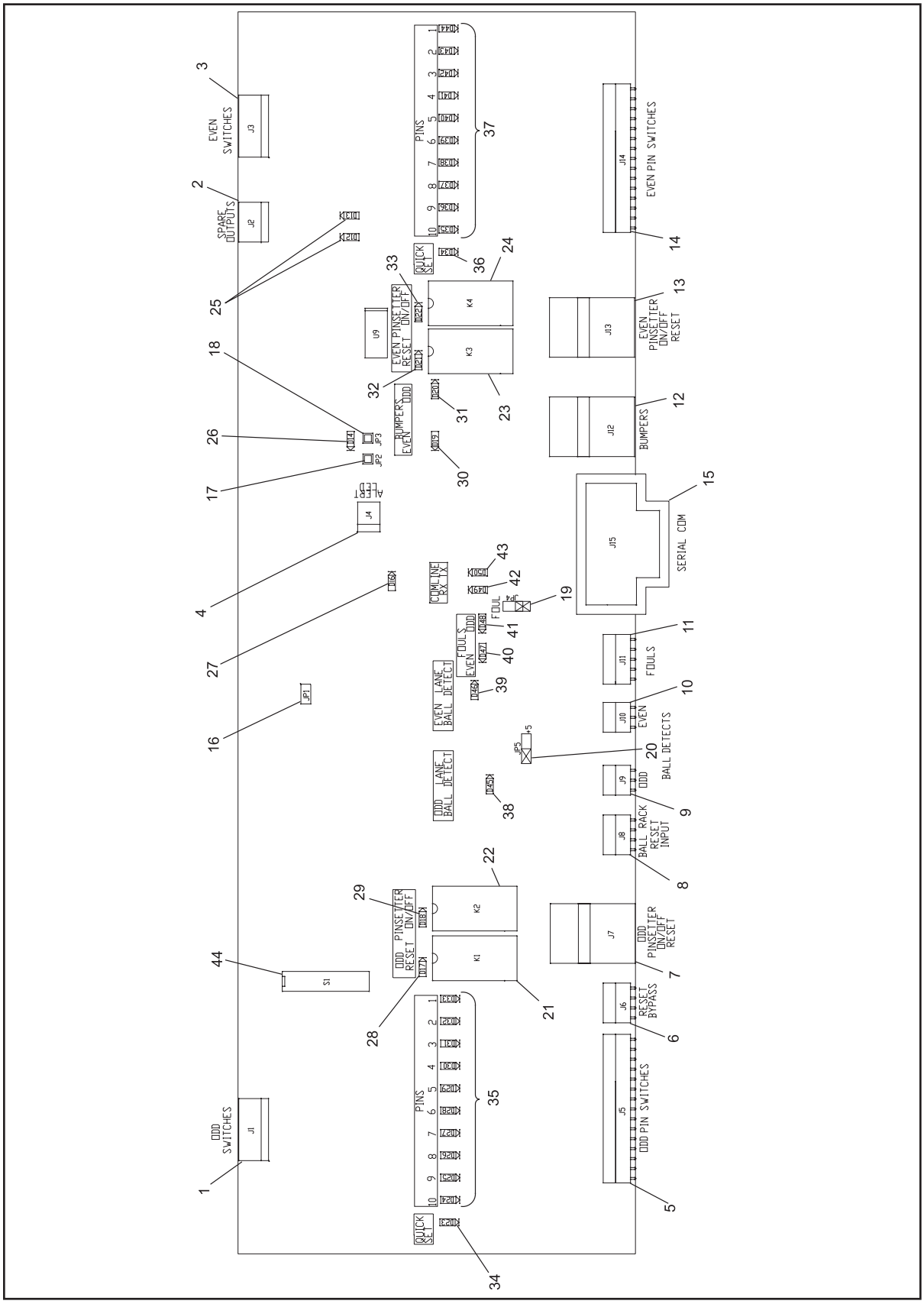


Figure 7-14. Interface PCB

The following is a description of the Inter face boxes' components and connections.

NOTE: *Right/Even lane LEDs are red and Left/Odd lane LEDs are green.*

(1) **Odd Switches (J1) -** Input for the "Pinsetter ON/Scorer Enabled" switch, "Ball Detect On/Off" switch and "Reset" (cycle) switch on the enclosure for the left/odd pinsetter.

(2) **Spare Outputs (J2) -** Unused outputs.

(3) **Even Switches (J3) -** Input for the "Pinsetter ON/Scorer Enabled" switch, "Ball Detect On/Off" switch and "Reset" (cycle) switch on the enclosure for the right/even pinsetter.

(4) **Alert Led (J4) -** Used for an enclosure mounted LED. When it is on, at least one of the pinsetters has either been manually turned on with the toggle switch on the enclosure or has turned off the ball detects.

(5) **Odd Pin Switches (J5) -** Input for the signals from the pin switches and quick set (on the Mendes pinsetters) on the left/odd pinsetter.

(6) **Reset Bypass (J6) -** Connection to allow the ball rack reset buttons to directly control the pinsetters, instead of having the interface board control when to reset the pins.

(7) **Odd Pinsetter Power/Reset (J7) -** Connection to the left/odd lane pinsetter. The interface PCB can turn the left/odd lane pinsetter on/off and reset (cycle) the pinset ter through this connection.

(8) **Ball Rack Reset Input (J8) -** Input for the ball rack reset buttons. The interface board will control when the ball rack reset buttons will reset the pins. Keeps the pinsetter and scorer in sync.

(9) **Left/Odd Ball Detect (J9) -** Connection for the signal and power for the odd lane ball detector.

(10) **Right/Even Ball Detect (J10) -** Connection for the signal and power for the even lane ball detector.

(11) **Foul (J11) -** Input for the signals from the foul units for both the left and right lanes. Also refer to (15) Foul Jumper (JP4).

(12) **Bumpers (J12) -** Connection to AMF/Qubica automated bumpers.

(13) **Right/Even Pinsetter Power/Reset (J13) -** Connection to the even lane pinsetter. The distribution PCB can turn the even lane pinsetter on/off and reset (cycle) the pinsetter through this connection

(14) **Even Pin Switches (J14) -** Input for the signals from the pin switches and quick set (on the Mendes pinsetters) on the right/even pinsetter.

(15) **Serial COM (J15) -**

(16) **Watch Dog Timer (JP1) -** open watchdog disabled

(17) **Ground Point (JP2) -** Not used

(18) **+5VDC (JP3) -** Not Used

(19) **Foul Jumper (JP4) -** Jumper used to configure the interface so that is can properly handle the foul input signal. When using Brunswick foul units or foul units that uses a relay type (switch) output, install a jumper to short the pins. If using a foul unit that supplies +12VDC as an output (AMF) remove the jumper.

(20) **Ball Detect Jumper (JP5) -** Jumper used to configure the interface PCB to power the ball detectors with 5VDC or a 12VDC. For Vector ball detects set the jumper to 12VDC.

(21) **Left/Even Lane Reset Relay (K1) -** When energized the left/even lane pinsetter triggers.

(22) **Left/Even Lane Power Relay (K2) -** When energized the left/even lane machine turns on.

(23) **Right/Odd Lane Reset Relay (K3) -** When energized the right/odd lane pinsetter triggers.

(24) **Right/Odd Lane Power Relay (K4)** - When energized the right/odd lane machine turns on.

(25) **LED D12/D13 -** "On" when the spare outputs are energized. D12-Left, D13-Right.

(26) **LED D14 -** "On" when +5VDC is present (board power).

(27) **LED D16 -** Blinking when the microprocessor is running.

(28) L**ED D17 -** "On" when the left/odd lane reset relay is energized to reset new pins..

(29) **LED D18 -** "On" when the left/odd lane power relay is energized, turning the pinsetter on.

(30) **LED D19 -** "On" when the right/even AMF/Qubica automated bumper is up.

(31) **LED D20 -** "On" when the left/odd AMF/Qubica automated bumper is up.

(32) **LED D21 -** "On" when the right/even lane reset relay is energized to reset new pins.

(33) **LED D22 -** "On" when the right/even lane power relay is energized, turning the pinsetter on.

(34) **LED D23 -** "On" when the left/odd lane is executing a quick set/cycle. (Mendes pinsetters)

(35) **LED D24-D33 -** Used to indicate the state of the pins for the left/odd lane. De pending on pinsetter type, "On" could indicate either up or down. Model "R" – On is down. Model 81-10 – On is up. Mendes 201E – On is up.

(36) **LED D34 -** "On" when the right/even lane is executing a quick set/cycle. (Mendes pinsetters)

(37) **LED D35-D44 -** Used to indicate the state of the pins for the right/even lane. Depending on pinsetter type, "On" could indicate either up or down. Model "R" – On is down. Model 81-10 – On is up. Mendes 201E – On is up.

(38) **LED D45 -** "On" when a ball detect signal occurs for the left/odd lane.

(39) **LED D46 -** "On" when a ball detect signal occurs for the right/even lane.

(40) **LED D47 -** "On" when a foul occurs on the right/even lane.

(41) **LED D48 -** "On" when a foul occurs on the left/odd lane.

(42) **LED D49 -** Flashes when the interface is receiving a message from the scorer.

(43) **LED D50 -** Flashes when the interface is transmitting a message to the scorer.

(44) **Dipswitch S1 -** An eight position dipswitch used to configure the interface.

Position 1 - Standing Pin Polarity - If the pin LEDs (D35-D44 or D24-D33) for a standing pin are off, then switch position should be OFF. If the pin LEDs (LED's D35-D44 or D34-D33) are on for a standing pin, then the switch position should be ON.

Position 2 - ON, 5-pin bowling

Position 2 - OFF, 10-pin bowling

Position 5 - ON, to identify a CA1 pinsettter (5 pin)

Position 5 - OFF, to identify all other pinsetters

Positions 3, 4, 6, 7, and 8 - Not Used.

Section 7 - Troubleshooting

Solutions to Common Problems

1. Machine and Accelerator Will Not Run

1. Check to see that the main switch is in the ON position.
2. Make sure the power cord is properly installed.
3. Check to ensure that the circuit breaker for the incoming power is not tripped or turned off.

2. One Machine Does Not Run

1. Make sure the motor stop switch on the Pinsetter for the non-running motor is turned ON.
2. Check to confirm that all electrical cables are properly installed.
3. Check to confirm that the disentangle switch (under the red cover at the front of the right hand pinsetter side frame) is in the closed position.
4. Make sure the "V" belt for the drive motor is not off the pulley or broken.
5. Fallen pim detect, page 6-27, step 9.

3. Accelerator Will Not Run

1. Check the overload on the contactor for the accelerator motor to make sure it is not tripped.
2. Make certain the accelerator drive belt is on the pulley and not broken.

4. Machine Will Not Stop After Completing a Cycle

1. Make sure the ball detect light is on. (Has 5VDC or 24VDC to unit.)
2. Check to see that the ball detect is clean and properly adjusted.
3. Check the ball detect cable. This can be done by switching the cables with the other machine on that pair of lanes.
4. Check the magnet on the SPIC to verify it is not stuck in line with the reed switch.

5. Machine Starts and Stops When Attempting to Lift Pins

1. Make sure there are not any pins or strings that are caught or not moving freely.
2. One or more pin strings have excessive spring tension.
3. Improper string tension on the pinsetter motor.
4. A replacement string has been improperly installed.
5. Watch the detangle switch to see if its actuator is functioning improperly.
6. Check detangle switch wiring.

6. Machine Cycles and All Down Pins are Recognized by the Scorer. The Pinsetter Respots One or More of the Fallen Pins.

1. Check to see that the solenoid that locks knocked over pins in the up position is functioning.

2. Check to make sure all pins are properly routed and free to move.

7. After First Ball, the Head Pin is Bottomed Out on Centering Cone Instead of Having a Gap of Approximately 80 mm

1. Open the string break manually and adjust the string tension (increase the length of the string).

2. Make sure the string of the affected pin moves freely.

3. Check the adjustment of the parallel and disentangle switches.

4. Make sure that the string solenoid is not constantly actuated.

5. Replace board number three with a board from a machine that is functioning properly.

8. A Machine is Malfunctioning But You Cannot Isolate the Problem

1. To determine if the problem is in the electrical box or with the machine, exchange the electrical boxes with those of a pair that are working properly.

2. If the problem follows the electrical boxes, exchange the control unit boxes. This should allow you to determine which of the boxes is causing the problem.

9. Pins Fall When Being Spotted or are not Respotted Accurately

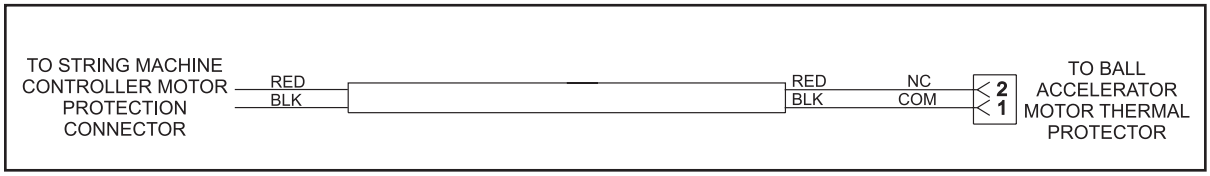
1. Check to see that the strings of the pin or pins being spotted are properly tensioned.

2. Check the adjustment of slow setting cams.

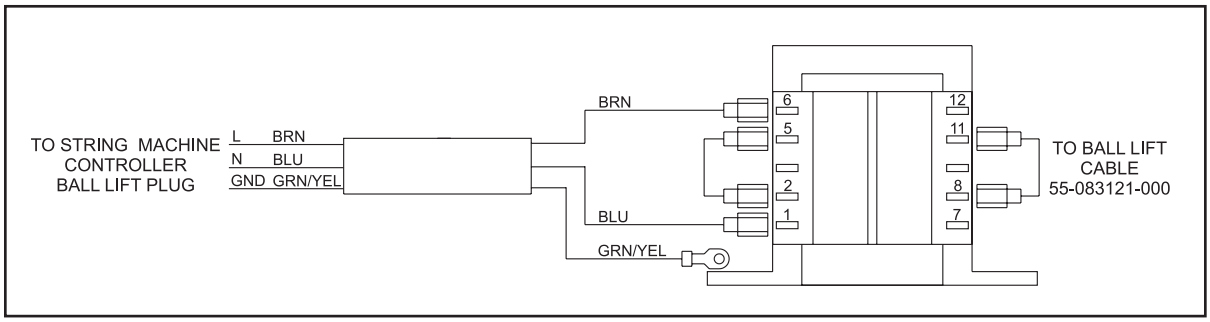
3. Check the location of the pin centering rings.

4. Check the centering plate for a broken rubber bumper.

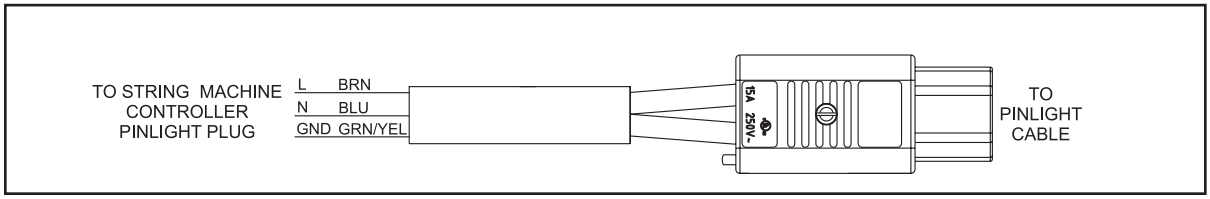
Section 8: Cables



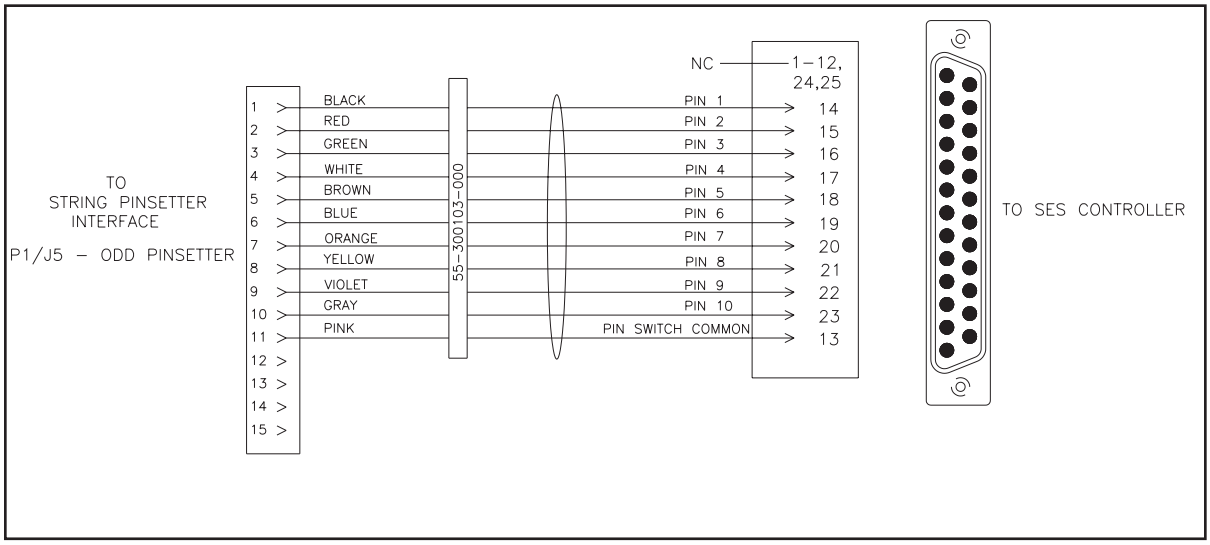
Ball Accelerator Motor Protection Cable Assembly (P/N 55-083119-001)



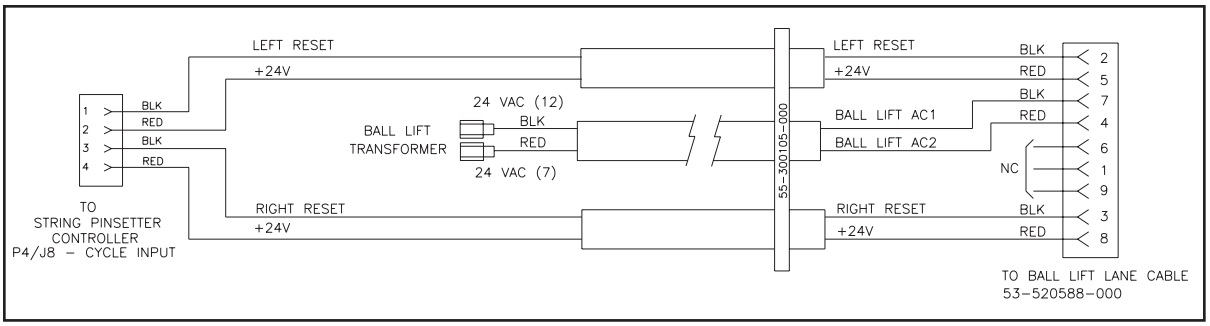
Ball Lift Power Transformer Cable Assembly (55-860030-001)



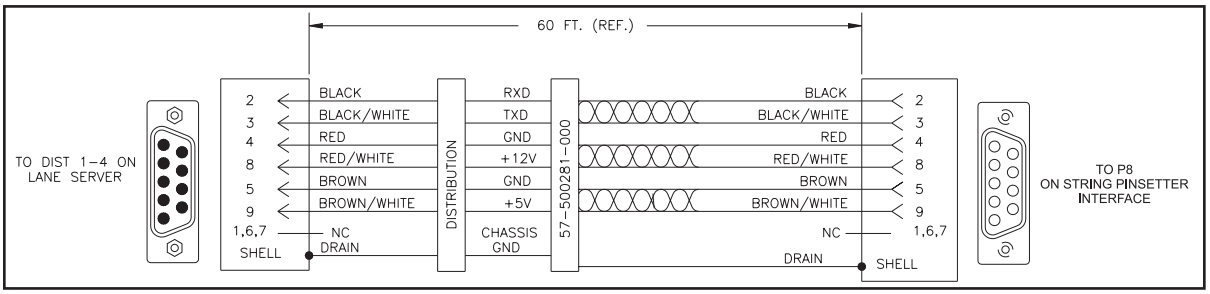
Pinlight Adapter Cable Assembly (P/N 55-276272-001)



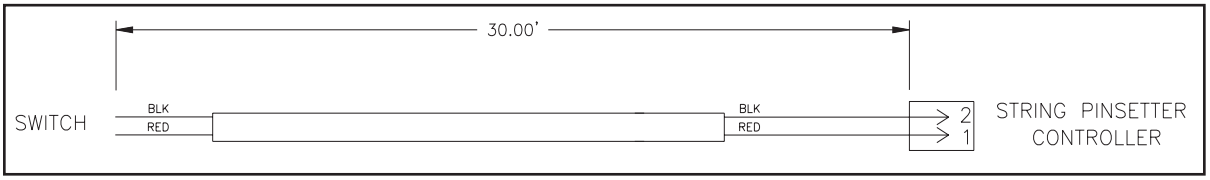
Pin Input, Odd Cable Assembly (P/N 55-300103-001)



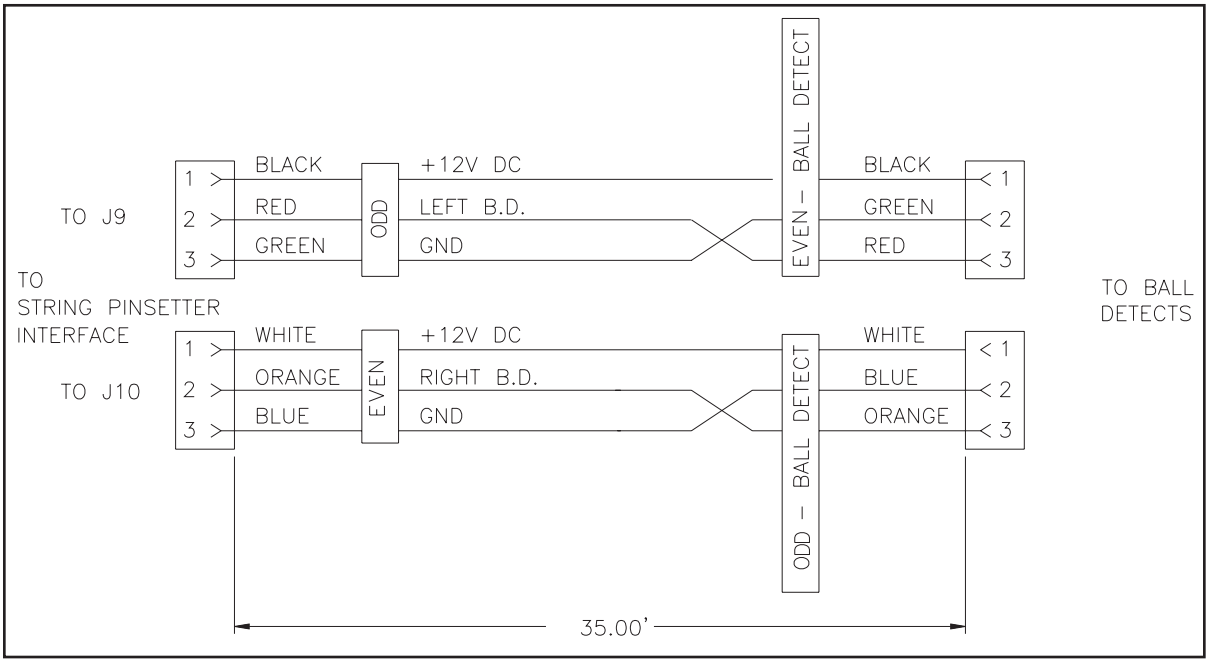
Ball Lift Control/Resets Cable Assembly (P/N 55-300105-001)



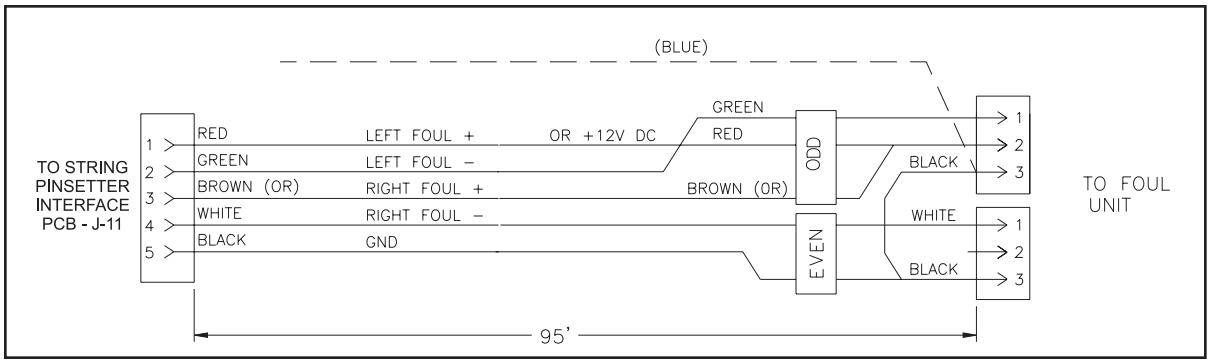
Scanner Data - Cable Assembly (P/N 57-500451-000)



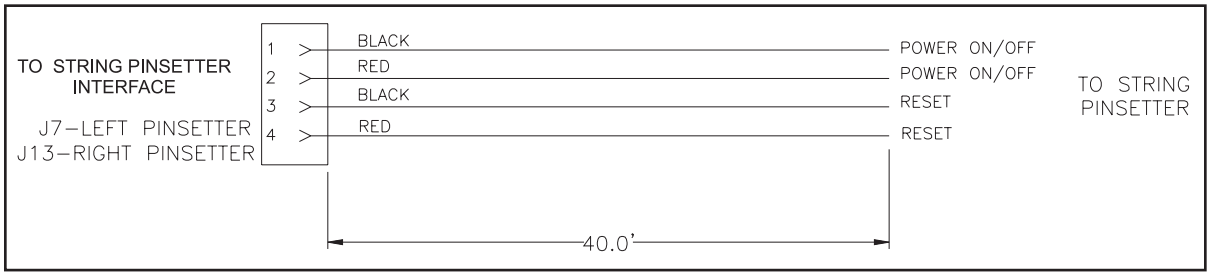
Remote Ball Detect On/Off Switch - Cable Assembly (P/N 57-500925-000)



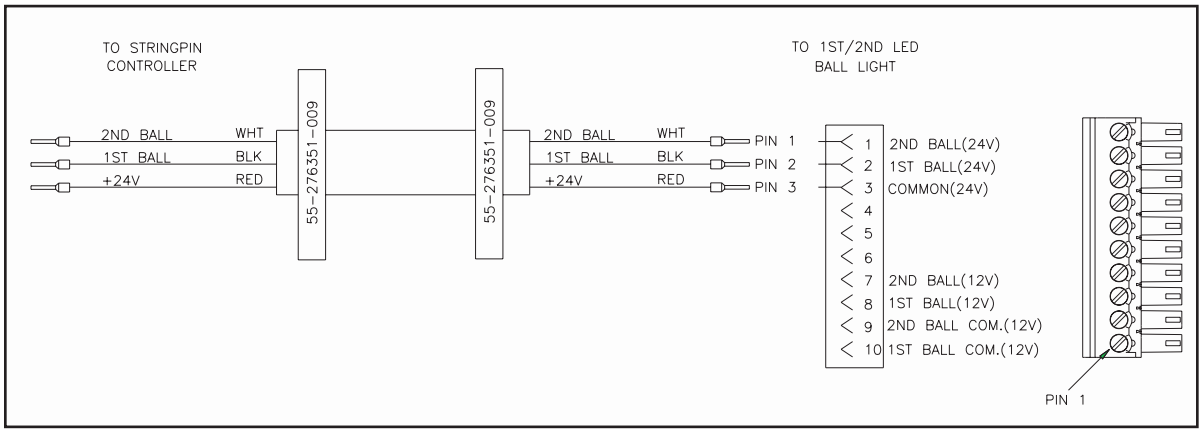
Ball Detect - Cable Assembly (P/N 57-500926-001)



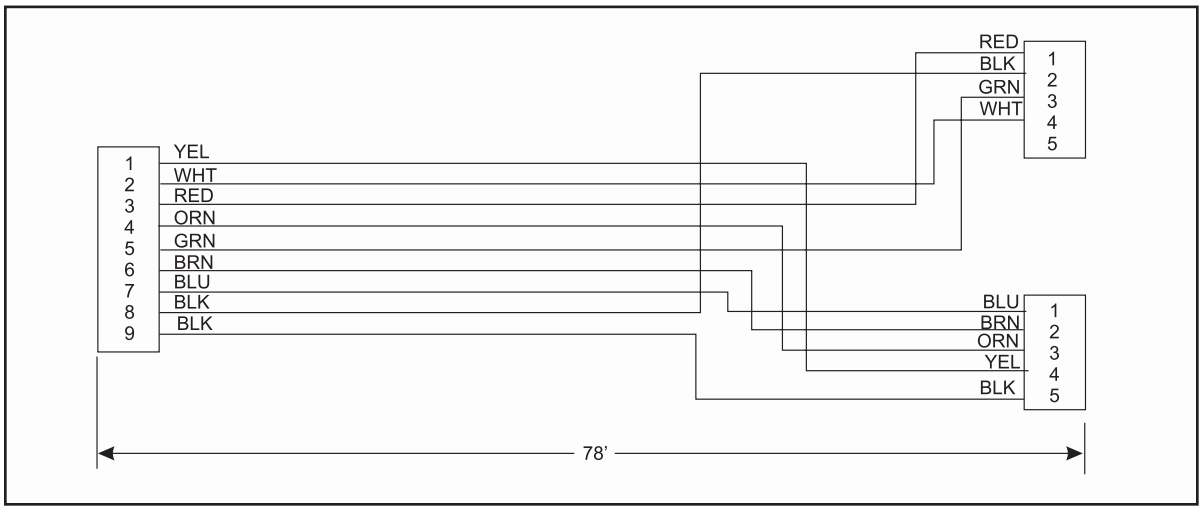
String Pinsetter Foul - Cable Assembly (57-500928-000)



On/Off Reset - Cable Assembly (P/N 57-500930-001)



1st & 2nd Ball Light LED String Machine Cable Assembly (55-860035-001)



Lane Cable, Ball Rack to A/P Control Cable Assembly (53-860691-000)